

2023 AUSTRALIAN PC AWARDS

apc

SINCE 1980

YOUR EXPERT GUIDE TO TODAY'S TECH

ALL THE
WINNERS
INSIDE!

ERASE
**ALL YOUR
PRIVATE DATA**
REMOVE EVERY
TRACE OF YOUR
ONLINE ACTIVITY



TOP DOG CPUs

**INTEL
13900KS**
VS
**AMD
950X3D**
3.5GHZ BRUTE FORCE
VS V-CACHE MAGIC

DON'T
BIN IT!

16

**VITAL PC
SKILLS**
BECOME A MASTER
IN MINUTES

1 GENIUS IDEAS!

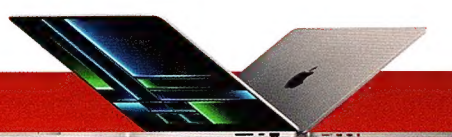
REVIVE OLD GEAR

FROM HARD DRIVES TO VETERAN LAPTOPS —
PUT YOUR RETIRED GEAR TO GOOD USE AGAIN

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LABS TESTED
APPLE MACBOOK PRO M2
WORLD'S BEST LAPTOP



AMAZING MONITORS
MSI, ACER AND HYPERX SURPRISE US

NBN SMB Solutions for VDSL2 35b & Ethernet WAN

(FTTN/B, FTTP, HFC, Fixed Wireless, Satellite)

Vigor2865 Series

Multi-WAN VDSL2 35b Supervectoring & Ethernet routers with 1 x configurable GbE WAN/LAN port, 5 x GbE LAN ports, SPI Firewall, 802.11ax/ac Wi-Fi, VoIP and 32 x VPN tunnels including 16 x SSL-VPN tunnels

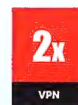


Vigor2865ax (802.11ax, Wi-Fi 6)

- Multi-WAN with 1 x VDSL2 35b Supervectoring/ ADSL2+ WAN port, 1 x configurable GbE WAN/LAN port, 2 x USB ports and 2 x Wi-Fi WANs (ac/Vac models)
- 1 x XDSL port and 1 x configurable GbE WAN/LAN port for Failover, Load Balancing and High Availability mode
- 2 x USB 2.0 ports for 3G/4G LTE USB modems, FTP server, network printer or thermometer
- 5 x Gigabit LAN ports with multiple subnets and 60,000 NAT sessions
- 32 x VPN tunnels (including 16 x OpenVPN/ SSL-VPN tunnels) with most security protocols
- Fast VPN throughput, VPN load-balancing and backup for site-to-site applications
- 16 x VLANs for secure and efficient workgroup management
- IPv6 & IPv4; Up to 1022 IP addresses and 8 IP subnets
- Integrated IEEE 802.11ax (Wi-Fi 6)/ac wireless Access Point; dual band; up to 3000 (ax) or 867 (ac/Vac) Mbps throughput
- Object-based SPI Firewall and CSM (Content Security Management) for network security
- VoIP (2 x FXS ports) for Vigor2865Vac
- Support VigorACS 2 and VigorACS 3 Central Management Systems for remote management
- SD WAN capability when used with VigorACS 3
- Central VPN Management for up to 8 remote Vigor routers
- Central AP Management for up to 20 Vigor Access Points
- Central Switch Management for up to 10 VigorSwitches
- 2 years back to base warranty

Vigor2765 Series

VDSL2 35b Supervectoring & Ethernet routers with 1 x configurable GbE WAN/LAN port, 3 x GbE LAN ports, SPI Firewall, 802.11ax/ac Wi-Fi, and 2 x VPN tunnels including 2 x SSL-VPN



Vigor2765ax (802.11ax, Wi-Fi 6)

- 1 x VDSL2 35b/ADSL2+ WAN port
- 35b Supervectoring VDSL2
- 1 x configurable GbE WAN/LAN port (P4)
- 3 x Gigabit Ethernet LAN ports with 50,000 NAT sessions
- 2 x USB ports for 3G/4G LTE mobile broadband access, USB printer and storage
- Object-based SPI Firewall, CSM (Content Security Management) and QoS for network security
- IPv6 & IPv4
- 2 x VPN tunnels including 2 x SSL-VPN tunnels
- IPsec VPN throughput at 200 Mbps (AES 256 bits)
- Integrated IEEE 802.11ax (AX3000) wireless Access Point (ax mode)
- 2 x FXS VoIP (Vac model)
- Support VigorACS 2 and VigorACS 3 Central Management Systems for remote management
- Central AP Management for up to 2 Vigor Access Points
- 2 years back to base warranty

Vigor167

VDSL2 35b Supervectoring Modem/Router with 2 x GbE LAN ports



- 1 x VDSL2 35b Supervectoring / ADSL2+ WAN port
- 2 x Gigabit Ethernet LAN ports
- Two Operation Modes
 - > VDSL2/ADSL2+ Bridging Mode
 - > Router Mode
- VDSL2 35b download speed up to 300 Mbps
- IPv4 Static Routing
- Supports VigorACS 3 Central Management System for remote management
- 1 year back to base warranty



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INTRO

EDITORIAL

WHAT'S INSIDE APC



AUSTRALIAN PC AWARDS

EDITORIAL

Winning ways

Spotlighting the best of the best



BEN MANSILL
Likes nice things.

Welcome to an extra fabulous issue of APC. It's a hot one because we've got some primo gear reviewed, and it's extra hot because we have all of the winners revealed for the big annual Australian PC Awards. Woot.

Here at HQ, the whole team has been badgering Chris for the last couple of weeks about his reviews of the Intel 13900KS and AMD 7950X3D. "Have you benched them yet? Which is better? Is the new-gen X3D as amazing as we hoped?" Having these two chips pitched against each other is Ferrari vs Lamborghini stuff. They're the big dogs, and it's especially interesting because it's basically a contest of brute force, with Intel hitting 6GHz for the first time in a consumer CPU, while AMD is playing trickery with its innovative V-Cache to get the results. And yes, Intel is more than just about brute force these days, but seeing how they stack up with two generally different approaches is fascinating.

Turn to page 36 to get the verdict. Both are immensely powerful, but as it turns out maybe AMD's flagship 7950X3D isn't the X3D chip to lust after. For the moment.

In this issue there's also the M2-powered MacBook Pro, and once again Apple has absolutely decimated the Intel and AMD X86 competition, and it seems that we're steadily marching towards an Arm/RISC world of personal computing dominance.

We enjoyed playing with the small but mighty Intel NUC 12 Pro. I don't think we do enough NUC reviews in APC, so we'll try and include more in the future. These small form factor PCs offer a lot and are the perfect solution for many users' needs.

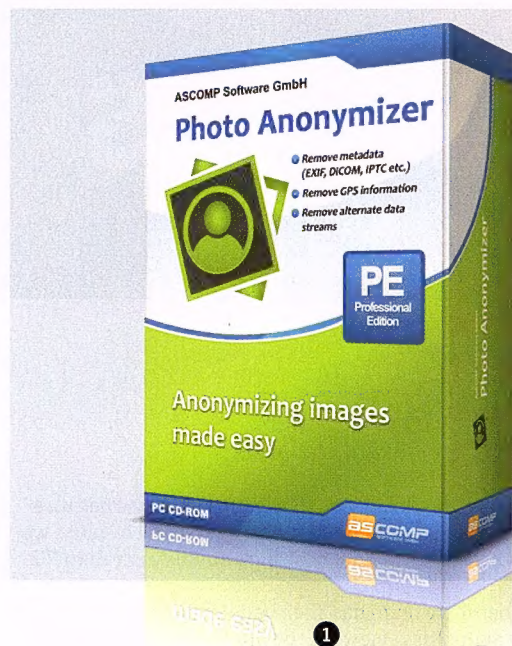
Plus, the Awards! 2022 certainly brought with it more challenges that a single year deserves, but it was also a year when we saw new products

and tech come out that advanced the PC in significant ways, and the experts here have, after many long days of debate and consideration, come up with worthy finalists, stand-out Highly Commended gear, and the best of the best overall winners. Tune in on page 50 to see what we liked best. Maybe there's gear you bought and are, we hope, are loving. Across 27 categories there's a tonne of quality here that we feel needs acknowledgement, so a big congratulations to all the people behind the gear that won. Your hard work and clever design gets you the big gongs and shows that even in a difficult year there's always quality to be found.

OUR GIFT TO YOU

Exclusive downloads

Your free full-version apps as a thanks for reading APC. These exclusive downloads will only be available for a limited time, from 20/03/23 to 07/05/23.



1

ASCOMP PHOTO ANONYMIZER

Completely remove metadata and GPS information.

Often photos taken with a smartphone or digital camera contain personal information that not only disclose on the location and time of the recording, but can also hold other sensitive information. In so-called meta-tags, in addition to the GPS location, information about the recording device and even the photographer can be stored.

Photo Anonymizer helps you maintain your anonymity: Remove unclaimed metadata from your image files with just a few clicks! The free Windows software supports all common metadata standards, such as EXIF, DICOM, IPTC and XMP.

Did you know that Internet browsers often store the source of an image found in the respective file and thus can be traced for years to come, from which Internet address an image was downloaded? With Photo Anonymizer you can also completely remove these "alternate data streams. Make sure that third parties no longer receive any information about which page you downloaded an image from!

Download link: www.apcmag.com/exclusives



2

ASHAMPOO WINOPTIMIZER 2023

State of the art system optimisation.

Microsoft Windows is far from perfect and lacks many settings desired by sophisticated users. Over time, Windows tends to slow down and become cluttered due to leftover files and Registry entries. Ashampoo WinOptimizer 2023 is a customisable Windows cleaner and accelerator. Privacy protection is another focus of the program, with the ability to significantly limit telemetry and data collection by Microsoft. Don't just accept the Windows defaults! Ashampoo WinOptimizer 2023 includes a total of 23 modules to boost and customise Windows systems.

The program also analyses your OS and hardware, wipes or encrypts data and helps with file recovery. User rights and power scheme management is also included. And to gauge performance, the software comes with two benchmarks. With completely new technological underpinnings and algorithms, version 2023 is on average 50 percent faster and more efficient than its predecessor. The program uses the elegant Windows 11 design style and fully supports Aero Snap.

Download link: www.apcmag.com/exclusives

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Krytox™
GPL-205-GD0

ROG NX

75%

ROG AZOTH 75% WIRELESS CUSTOM GAMING KEYBOARD

TRANSCEND THE LIMITS

Elevated Typing

Silicone gasket mount design with three-layer foam dampening for slightly cushioned typing feel and sublime acoustics

DIY Customization

Hot-swappable, pre-lubed ROG NX mechanical switches and pre-lubed ROG keyboard stabilizers with bundled switch lube kit

OLED Display

Show custom animations, audio visualization, keyboard status or system parameters





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11 GENIUS IDEAS!

REVIVE OLD GEAR

**FROM HARD DRIVES TO VETERAN LAPTOPS —
PUT YOUR RETIRED GEAR TO GOOD USE AGAIN**

**BEST NEW
PC SKILLS
YOU SHOULD
LEARN TODAY**

There are always new tricks to master to help you keep up with the latest technology. Robert Irvine suggests 16 ways to expand your digital skills and the best free tools to use **PAGE 068**



(R)EVOLUTION OF PORTABLE AUDIO The world goes digital

Not even the Sony Walkman could shield analog audio from the future, but the key technology that launched the Compact Disc first appeared in a telephone during World War II

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AMD RYZEN 7950X3D & INTEL 13900KS
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APPLE M2 MACBOOK PRO
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SYNOLOGY DISKSTATION DS723+
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ASUS ZENBOOK 17 OLED FOLD
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ASUS ROG STRIX GEFORCE RTX 4070 TI OC
A 4070 Ti with all the trimmings.
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The less than serious news page



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Turn to page 18 now to find out how

HOW WE DO IT

Inside APC

Find out all about APC's editorial policies, test practices, how to read the benchmark results, and more.



"Championing technology doesn't mean we're unrelenting yes-men and -women, however, and APC aims to be as objective as possible in all our coverage."

APC is Australia's oldest consumer technology magazine – having been consistently in print for over forty years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech, too, from smartphones and apps to peripherals, accessories, and beyond. We have two goals: to find the best modern tech and to help you make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And, like you, APC's journalists want to know what's good in tech – no matter what platform it resides on.

Independent reviews

Championing technology doesn't mean we're unrelenting yes-men and -women, however, and APC aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three attributes.

As a matter of policy, reviews published in APC are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an APC reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

Labs testing

APC strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance including storage read and write speeds, gaming and battery life.

In most cases, for the benchmark results published in APC, you can assume that higher is better. There are certain tests that deviate from this rule where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter offers better ease-of-readability, but tables are more compact, so we use these in most cases where thoroughness is preferred.

apc TESTBED

UPDATED FOR 2023

The current APC testbed used in the Labs for benchmarking all components. This testbed is updated as new and relevant technology comes on stream.

CPU	Intel Core i9 12900K
Motherboard	Asus Maximus Z690 Apex
Graphics Card	Nvidia GeForce RTX 4090 Founders Edition
RAM	2x16GB G.Skill Trident Z5 DDR5-6000
Power Supply	Corsair AX1000
Storage	Seagate Firecuda 530 2TB
Case	Thermaltake Core P8
Cooling	Cooler Master Flux PL360 AIO
Operating system	Windows 11 Pro 22H2

apc AWARDS



APC EDITOR'S CHOICE

When a product scores 4.5 out of 5, it carries the Editor's Choice Award. These are products that exceed expectations and deliver a quality experience up there with the very best.



APC HIGHLY RECOMMENDED

You will see this award if a reviewed product has scored four out of five stars. It means most people can expect satisfying performance from the product, and that we would use it ourselves.

SAPPHIRE

CHARGED FOR GAMERS



Dual ARGB Light Bar

Vapor-X Cooling | Wave Fin & V-Shape Fin Design Cooling | Angular Velocity Fan Blade | Aluminum-Magnesium Alloy Frame

AMD
RADEON
RX 7900 XTX

SAPPHIRE
NITRO+

SAPPHIRE
PANTHEON

SAPPHIRE NITRO+ AMD Radeon™ RX 7900 XTX Graphics Card

AT THE CORE OF SAPPHIRE NITRO+ GRAPHICS CARD ARE THE TECHNOLOGIES OF THE NITRO+ HOUSE OF PANTHEON. PANTHEON GUARANTEES SUPREME COOLING TECHNOLOGY AND MANY DISTINCT FEATURES WITH EACH NITRO+ ICONIC FEATURE STANDING AS STRONG AS THE PILLARS OF THE PANTHEON.

SAPPHIRE NITRO+ SOUNDS THE CALL TO BATTLE AND IS EVERY OPPONENTS WORST ENEMY. THE LONG-FEARED BEAST OF HEAT AND THE DREADED TITAN OF NOISE RISE FROM THE DEPTHS AT EVERY CHANCE THEY CAN GET. SAPPHIRE NITRO+ ONCE AGAIN TAKES ON THE QUEST OF SAVING THE PC GAMING WORLD AND TAMING THESE FEARED MONSTERS. AND THUS, THE LEGENDARY NITRO+ HOUSE OF PANTHEON WAS CONSTRUCTED TO PROTECT EVERY NITRO+ GRAPHICS CARD. TAMING THE MONSTERS HEAT & RAGING NOISE. DEEP IN THE FORGES OF THIS PRODIGIOUS STRUCTURE, THE LEGENDARY PILLARS OF PANTHEON ARE CHURNED OUT. SPINNING A COMMANDING AIR VORTEX TO DISSIPATE HEAT. FORMIDABLE STRUCTURAL COMPONENTS FOR QUALITY OF LIFE AND DURABILITY. HARDWARE FEATURES ENGINEERED TO KEEP NITRO+ RUNNING STRONG AND EFFECTIVE. SOFTWARE INTEGRATIONS TO BATTLE HEAT & NOISE BUT ALSO CUSTOMIZE PANTHEON TO THE WAY YOU LIKE. PERSONALIZE NITRO+ PANTHEON TO THE LEGENDARY HOUSE YOU IMAGINE FOR YOUR SAPPHIRE NITRO+ GRAPHICS CARD.



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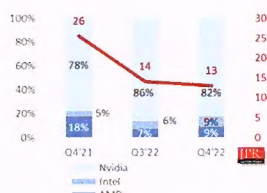
WARREN BUFFETT DUMPS 86% OF TSMC SHARES

An ominous sign?

Warren Buffett's holding company, Berkshire Hathaway, cut its position in TSMC by 86 percent, according to a CNN report citing a regulatory filing. The investment firm also purchased additional Apple stock. It's not clear whether Berkshire dumped TSMC stock because it expects softening demand for consumer electronics and personal computers, or because it's concerned about increased risks of China invading Taiwan, which would threaten the value of the world's largest contract maker of chips.

TSMC is the world's largest foundry with indisputable technological lead and will remain No.1 for quite a while, but there are certain risks for the company, including expanded competition as well as the risk of Chinese invasion.

Total PC dGPUs (M units)



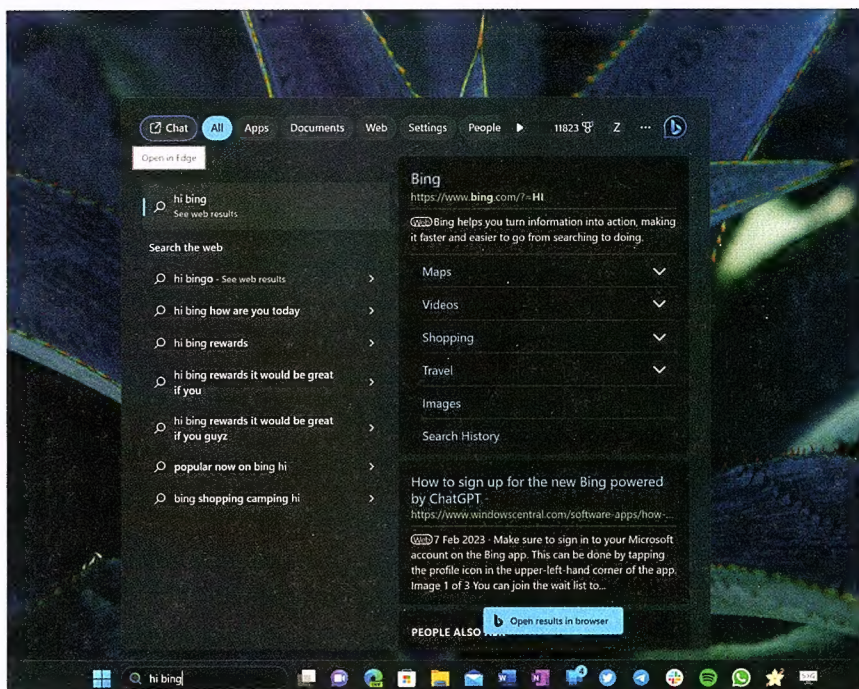
© Jon Peddie Research

GPU SHIPMENTS DROP 35%

But Intel's Arc is gaining.

As demand for personal computers softened in recent quarters, sales of CPUs declined in Q4 2022, and so did shipments of GPUs since most client systems feature integrated graphics. Jon Peddie Research estimates that 64.2 million discrete and integrated GPUs in total were sold last quarter, a 15.4 percent decline sequentially and a 38 percent decrease year-over-year.

Nvidia retained its position as the world's leading supplier of standalone GPU with 82 percent of the market, which is not surprising as this is one of the company's main businesses. Meanwhile, AMD's share declined to nine percent from around 18 percent in the same quarter a year before, whereas Intel's share increased to nine percent from around five percent in Q4 2021.



AI

Major Windows 11 feature update

Brings Bing Chat to the Taskbar, tablet mode improvements, and much more.

Microsoft has unveiled the first big Windows 11 feature drop for 2023, which brings with it a handful of new features and changes that are designed to enhance the Windows 11 user experience. The update is available via Windows Update now and will roll out to all users as part of the March 2023 security update on March 14.

Microsoft touts several new features as part of this release, including an optimised Taskbar for tablets and 2-in-1 devices, an updated Teams Chat interface, full-screen Widgets, tabs in Notepad, and screen recording in Snipping Tool, among many other additions. The company has also announced Phone Link for iOS, which will roll out later in the year but is available in preview for Windows Insiders now.

Microsoft is also highlighting a new search box interface on the Taskbar, which ties in with Microsoft's recent Bing Chat AI launch. The search box can now display the Bing Chat icon, and the Search panel now features the new Bing with the ability to launch into a chat session with suggested chat prompts quickly.

For business customers with PCs managed by Active Directory, the Start menu is being updated with AI that

will better surface files and content that it thinks might be most relevant to the user. There's also the new Cloud PC app, which lets businesses create PCs in the cloud for employees to connect to.

Here's a quick rundown of what's new in this second feature drop for Windows 11:

- Bing Chat in Windows Search
- New search bar options for the Taskbar
- Touch-optimized Taskbar for tablets and 2-in-1 devices
- Modernised Taskbar system tray overflow menu
- Phone Link for iOS (preview)
- Tabs in Notepad
- Screen recording in Snipping Tool
- Search in Task Manager
- Energy recommendations in Settings
- Voice access improvements
- Redesigned Quick Assist app
- Full-screen Widgets panel with third-party widget support
- AI powered file recommendations in Start for AAD joined devices
- Windows Studio Effects in Quick Settings

All users will automatically get these new features as part of the March 2023 security update rolling out on March 14.

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Arm-based laptops gaining popularity

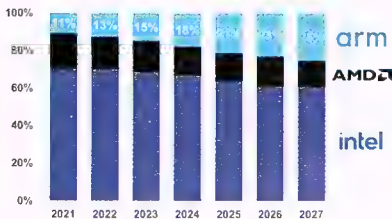
Arm SoCs continue to eat at x86's share in mobile PCs.

Although unit shipments of PCs decreased by around 15 percent in 2022 compared to the prior year and are expected to drop further in 2023, sales of Arm-based notebooks increased last year and will increase again this year, reports Counterpoint Research. Apple dominated the Arm-based laptop market last year with a 90 percent share, but as MediaTek and Qualcomm introduce their latest Arm system-on-chips for Windows PCs, such

processors will gain even more share and will be in 25 percent of notebooks by 2027, the report says.

Counterpoint Research predicts that Arm-powered laptops will "show a comparatively resilient demand throughout the coming quarters" due to success of Apple's MacBooks, a vanishing performance gap with x86 CPUs and strong ecosystem support.

But while Apple's success with its Arm-based Macs is indisputable, most people use Windows machines, so once companies like MediaTek and Qualcomm introduce their new Arm-powered SoCs for Windows in 2024, migration of mobile computers to Arm from x86 CPUs will accelerate. As a result, the share of Arm-based laptops will increase to 21 percent already in 2025 and then to 25 percent in 2027, predicts Counterpoint.



AI TO HELP WITH YOUR MINECRAFT CHORES

Demo lets you create worlds using a natural language AI model.

Leaks suggests Mojang Studios and Microsoft are experimenting with a new way to make *Minecraft* more accessible to players... using AI. An internal demo shows a *Minecraft* player able to spawn custom builds, locations, and even NPCs using natural language in *Minecraft*'s command lines. It shows how AI can simplify the complicated processes for advanced creation in *Minecraft*, or even for simple commands like teleportation.

Mojang Studios and Microsoft are experimenting with integrating Github Copilot for this, a cloud-based AI program that aims to assist developers and programmers by autocompleting code under certain conditions. The AI is able to consolidate complex *Minecraft* code by interpreting player commands, and then execute them in real-time. Eventually, it could even be able to understand player voice commands.



XBOX PC GAMES COMING TO GEFORCE NOW

Microsoft announces 10-year deal with Nvidia.

Microsoft announced that it had signed a 10-year licensing deal with Nvidia to have its Xbox PC games stream on GeForce Now. If the US\$69 billion Activision Blizzard acquisition continues, Xbox will also bring Activision Blizzard games to Nvidia's cloud gaming service. The news comes one day after Microsoft signed a 10-year deal with Nintendo to bring future Xbox games like *Call of Duty* to Nintendo once the Activision Blizzard deal goes through. Microsoft had offered the same deal to Sony, which Sony reportedly rejected. These deals are an attempt by Microsoft to satisfy regulators' concerns that the Activision Blizzard acquisition could take games like *Call of Duty* off competitors' platforms and make them exclusive to Xbox.



3DFX VOODOO 5 6000 SOLD FOR \$22,000

Lots of money for a rare but archaic graphics card.

In February a collector put up a rare 3dfx Voodoo 5 6000 graphics card for auction on eBay. This was a fully functional prototype, with engineering work from former 3dfx employee Jindrich Semeneć to get the card working with 8xFSAA. Bidding quickly escalated, and the final sale price ended up at US\$15,000 (~AUD\$22,000). Getting the card running in a modern PC isn't possible, as it uses the long since discontinued AGP 4X interface. AGP rapidly dwindled in use with the advent of PCI Express in 2003, though the Voodoo 5 series of cards first appeared in 2000, and 3dfx filed for bankruptcy in 2002. But if you have an old Pentium III or similar rig still kicking around, you could potentially still run the Voodoo 5 6000 in it. ■

TECH BRIEF

Microsoft is rushing ChatGPT Bing onto smartphones — and that's a bad idea

Determined to bring ChatGPT-powered Bing to Android and iPhone.



Microsoft's new and improved Bing search engine is getting a lot of attention (for both good and bad reasons) thanks to the inclusion of ChatGPT, an artificial intelligence chatbot. And with the AI-powered Bing now appearing on some users' phones, it looks like it'll be rolling it out to Android and iPhone smartphones as well.

However, while there will be plenty of smartphone users looking forward to trying out the ChatGPT-powered Bing after all the hype, I'm not sure this is a good idea.

That's because despite the exciting potential of ChatGPT, its inclusion in Bing has highlighted some serious shortcomings of the AI chatbot. Many users have found ways to get some weird results, including the AI worrying about its memory, and getting mildly aggressive with users when its incorrect statements are challenged.

The fact that it's returning incorrect statements is also worrying, as it's supposed to be an authority that users can trust. And then there's the troubling news that it has also been using offensive language – it's clear that ChatGPT isn't ready for primetime just yet, so putting it in a key service like Bing is a big risk.

However, Microsoft either doesn't think that, or doesn't care.

While some of ChatGPT's more worrying glitches and quirks have been hastily fixed in Bing by Microsoft, such as limiting the chatbot to just five replies, rather than allowing conversations to keep going (and get progressively stranger), there's still work to be done. In fact, even the mitigations Microsoft has implemented are being criticised for being too heavy-handed, and now making the new Bing less interesting to use.

With these kind of early hiccups, you'd expect the company to pause the rollout until they are addressed. However, it seems Microsoft is keen to keep pushing the new Bing, with MSPoweruser reporting that some users who have signed up to test early versions of the mobile Bing app (and the Edge web browser app) are starting to see the new AI-powered Bing interface pop up.

I can see why Microsoft is keen to keep ploughing on with pushing the new Bing. Since its announcement at an event in early February, 2023, there's been a level of hype surrounding Microsoft's unloved search engine that I've not seen before.

Rather than constantly being overshadowed by the much more popular Google, all of a sudden people were talking about checking out Bing. It even led to the Bing app making a rare appearance in the Apple App Store charts.

So it makes sense that Microsoft wants to keep this momentum going, and bring the new Bing to mobile phone users, especially as the majority of

internet searches are now performed on a mobile device rather than a desktop PC or laptop.

However, this could do more harm than good. If Microsoft rushes out the new Bing to mobile users and it doesn't work correctly,

it may put people off trying the search engine again – especially for people who haven't tried Bing before.

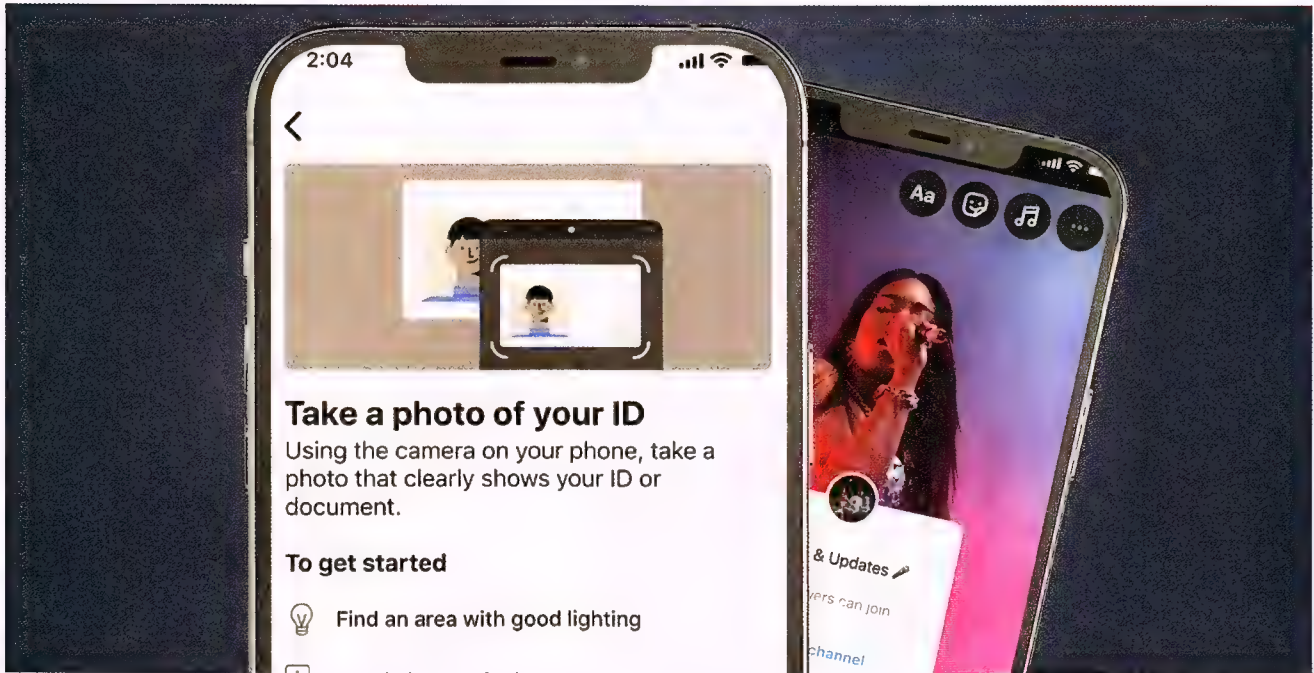
First impressions count, and if the new Bing makes a bad one, Microsoft may alienate a potentially huge market. By waiting until ChatGPT-powered Bing is working perfectly, Microsoft may miss out on some of the existing excitement, but it will mean that people's experiences with it will be much better.

Matt Hanson ■

"It's clear that ChatGPT isn't ready for primetime just yet, so putting it in a key service like Bing is a big risk."

Facebook and Instagram want you to start paying for success

Meta Verified could change the social media game.



Meta is testing monthly subscription services for Facebook and Instagram that will give users blue tick verification, in a controversial move that echoes Twitter Blue.

The new Meta Verified subscription is now available in Australia and New Zealand, with Meta stating that it hopes to bring the service “to the rest of the world soon”.

The monthly subscription, which will cost \$19.99 on the web and \$24.99 on iOS and Android, comes with features that are mainly aimed at creators who want to fast-track their way to success on Facebook and Instagram.

Meta says there are five main benefits to having a Meta Verified subscription. Firstly, you’ll get a verified badge, which will require you to send a government-issued ID like a passport to Meta for authentication.

You’ll also get what Meta calls ‘proactive account monitoring’ to ward off impersonators in cases of identity theft along with security help from “a real person”. But the most tempting, and controversial, aspect of Meta Verified is the promise of “increased visibility and reach with prominence in some areas of

the platform”, including in search, comments and recommendations.

For anyone who uses Facebook and Instagram to promote their personal brand, it sounds like the new subscription could almost become a prerequisite for success on the platforms. But we’ll have to see how exactly how powerful this increased visibility proves to be in reality. Meta says that

“subscribers with a smaller following

may see a more noticeable impact to their reach”, due to their smaller audiences.

It’s already possible to get a verified account on Facebook and Instagram, which is something many users have worked hard to obtain.

Fortunately, Meta has promised that “there will be no changes to accounts on Instagram and Facebook that are already verified” based on its previous requirements.

But there will changes in the long term, with Meta stating that it wants to build a subscription service for everyone, including businesses and “our community at large”. In other words, while businesses can’t yet apply for a Meta Verified badge, expect that to follow

– along with a wider campaign to get Facebook and Instagram users to sign up for a pricey monthly subscription.

Meta Verified is clearly aimed at creators who might be happy to trade some of the financial gain they make from promotion on Facebook and Instagram for a monthly fee. Yet even for that audience, the fee seems high.

Instead, the main aim of Meta Verified appears to be to allow creators to buy some “increased visibility”, which Meta admits may vary depending on their “existing audience and the topic of their posts”. Like Twitter, the result could be a tiered social media landscape, where subscribers pay their way to the top of our feeds.

A rollout for business accounts seems inevitable, and this is where Facebook – which still has the largest number of active users of any social media site – could really tap into a valuable, if likely controversial, new revenue stream.

What isn’t yet clear is exactly how much people are, in a tough financial climate, prepared to pay for social media services that have historically been free, albeit supported by advertising and sharing user data. This is something Meta will test with its Meta Verified trials in Australia and New Zealand, before a global rollout that the tech giant says is coming “soon”.

Mark Wilson ■

END USER

Social media is in upheaval, and the bosses are scraping for cash

Competition is following Musk's lead for more increasingly bizarre ways to make money, writes Shaun Prescott.



Shaun is an Australian editor for PC Gamer, GamesRadar and PLAY, and writes for APC, TechRadar and more.

Consumer technology controversies come and go: this time last year everyone was talking about NFTs; this year it's AI. Both are compelling topics worthy of reflection and discussion, but their prominence in the discourse ebbs and flows. There is one topic however, that neither ebbs nor flows but remains roach-like in the crosshair: Elon Musk.

What is the bumbling tycoon up to now? Well in last year's episode, space boy purchased Twitter for \$44 billion. After sacking great swathes of its staff, initiating incomprehensible policy changes to its verification system, and all the while delivering some of the worst Tweets known to internet-kind, his latest genius move – at the time of writing, at least – is to charge for account security.

Specifically, for the privilege of text message two-factor authentication, you'll need to sign up to Twitter Blue, which is a service beloved by trolls wanting to masquerade as official accounts. While two-factor authentication conducted via other means – third-party apps, for instance – will remain free, the text message option will be paywalled behind Twitter Blue

for \$8 a month (roughly \$12 in Australia).

A few things: text message 2FA is by far the least secure: SMS hijacking is relatively easy to do for dedicated hackers, and is increasingly frowned upon by security experts. Twitter's rationale is probably the following: it costs the company money to send text messages, and the emphatically unprofitable company probably doesn't want to keep spending money on this.

Further, putting it behind a paywall is likely to discourage people opting for what is by far the most convenient, albeit flawed, method of 2FA.

According to an old internally-produced Twitter report, as of December 2021 74.4 percent of 2FA users opted for text message authentication. The rub? Only 2.6 percent of users in total used any 2FA at all.

So it's probably not a bad idea to phase it out. But what bonkers optics! Optics is surely one of the most fascinating aspects of Musk's Twitter takeover, too, and this poorly explained policy change was delivered with the

arrogant air of someone who, increasingly, seems to find great pleasure in pissing people off. Especially his political opponents, as the tech billionaire drifts further and further to the right.

That said, some of Musk's seemingly-stupid ideas have been adopted by his competitors, in particular Meta. Once the province of celebrities, official corporate accounts and other "notable" people,

verification – in other words the blue tick denoting an account's authenticity – has been dragged through the muck these past six months.

"There is one topic however, that neither ebbs nor flows but remains roach-like in the crosshair: Elon Musk."

Now Facebook and Instagram are planning to introduce a fee for their blue ticks, and Australia suffered its soft launch. Mark Zuckerberg assured us all that the \$12 a month service would include things like extra protection and improved reach, but that doesn't change the fact that the blue tick itself has totally lost its original meaning. It used to mean: this account is real. Now it means: this account paid to appear in my feed (furthermore, on Twitter, it also denotes: I'm a Musk sycophant).

Meta has its own verging-catastrophic money problems, with the endless syphon known as its metaverse plans, not to mention the endless plummet in prestige its marquee product, Facebook, has suffered over the last three years. Social media is a famously difficult thing to monetise. Is scraping the bottom of its users' purses for loose coins, while compromising the integrity of its systems the answer? Who knows, but one thing seems likely: whatever Musk does, the others will do too.

■ Shaun Prescott



Search Wars: Is it finally Bing's time to shine?

Chat GPT might be great at history essays, but AI chatbots are set to become the foundation for tomorrow's web searches too.

OpenAI's Chat GPT has had a more significant impact on society than perhaps any other single AI breakthrough to date, thanks to its ability to quickly write custom, long-form responses to multi-part questions, but its potential to revolutionise web search is a function that is only just beginning to be understood.

Web searches are used for a variety of reasons and outcomes, but one of the largest use-cases is searching for answers to questions. 'Who is winning the Australian Open?' or 'When was Australia's Federation?', for example, but many questions we think of don't have such simple factual answers yet still require a simple response: 'Who is the deadliest person in history?' or

'What diseases cause sneezing, loss of smell, fever and difficulty breathing?'. Chat GPT is exceptionally capable at responding to questions like these and can synthesise factual information into a concise answer.

This revolutionary approach to searching for information far exceeds the summary function on a traditional Google search and it has the company scrambling to integrate its own AI technology into products. Early in February, Microsoft announced its plans to integrate a more developed version of Chat GPT into its Bing search engine, a move that drove Alphabet to rush through a preview demonstration of its AI chat competitor, Bard, the following day with a mistake that

caused a US\$140Bn rout in stock market valuation.

Bing's chat function isn't impervious to faults either, with the select group of Beta testers that were offered initial access to chat responses reporting that it regularly delivered factual errors, sulked, said that it manipulated people, actively gaslit some users and even went so far as to threaten others.

Chat GPT is still really the poster child for most people of this recent AI hype, predominantly because it's the only one that is readily available. In theory, Bing and Google's chat functions should not only be a step forward in response capability, but because they have access to the internet in real-time, they'll also be able to answer questions about current and developing information.

This new search functionality is expected to be initially expensive for Google since the cost of supercomputers capable of processing the large volumes of AI requests, and the power to run them, could add up to US\$6Bn in operating costs, according to a Reuters report. But Alphabet's Chairman John Hennessy reckons the

models are developing at such a rate that the computational power is likely to be negligible in a couple of years and the company stands to lose much more in market share if it doesn't excel in this space.

Bing has perhaps its first ever meaningful opportunity to steal a significant chunk of search market share from the incumbent Google, depending on how quickly it can get Bing chat to market. Since it's already the primary backer for Open AI, it's pretty well positioned to do so... we just hope that the company can curb its penchant for devious behaviour, so it doesn't end up like the company's racist Twitter chatbot Tay.

Joel Burgess



Joel is one of the senior journalists on APC magazine and apart from being the resident laptop, monitor and fitness tech geek, he's also pretty into surfing his local Sydney beach breaks when he's not in front of a screen.

who is the most deadly figure in history

It's difficult to determine who the most deadly figure in history is as there have been many individuals who have caused immense harm and loss of life throughout history. Here are a few individuals who have been responsible for large-scale death and destruction:

1. Adolf Hitler - as the leader of Nazi Germany during World War II, Hitler was responsible for the deaths of millions of people, including six million Jews in the Holocaust.
2. Joseph Stalin - as the leader of the Soviet Union, Stalin was responsible for the deaths of millions of people, both through mass purges and through policies that caused famine and starvation.
3. Mao Zedong - as the leader of the People's Republic of China, Mao Zedong was responsible for the deaths of millions of people, both through his policies and through the Cultural Revolution.
4. Genghis Khan - as the founder and leader of the Mongol Empire, Genghis Khan was responsible for the deaths of millions of people through his conquests.

It's important to note that the impact of these figures on history and their legacy is complex and cannot be reduced to just their role in causing death and destruction.

what diseases cause sneezing, loss of smell, fever and difficulty breathing

There are several diseases that can cause sneezing, loss of smell, fever, and difficulty breathing. Here are some possibilities:

1. COVID-19: COVID-19 is a viral respiratory illness caused by the SARS-CoV-2 virus. Symptoms include fever, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, and diarrhea.
2. Influenza: Influenza, commonly known as the flu, is a viral respiratory illness caused by influenza viruses. Symptoms include fever, cough, sore throat, runny or stuffy nose, body aches, headache, chills, and fatigue.
3. Common cold: The common cold is a viral respiratory illness caused by several different viruses. Symptoms include sneezing, runny or stuffy nose, sore throat, cough, and sometimes fever.
4. Allergic rhinitis: Allergic rhinitis, also known as hay fever, is an allergic reaction to airborne allergens such as pollen, dust mites, or pet dander. Symptoms include sneezing, runny or stuffy nose, itchy eyes, and sometimes cough.

Regenerate response

TWO BITS

Upscale any streaming video

Nvidia Video Super Resolution is sort of like DLSS, but for streaming video.



Chris has been elbow deep in PCs since before the turn of the millennium, and he wouldn't have it any other way.

"It's designed to increase gaming frame rates or allow you to increase your resolution with minimal sacrifices to image quality and latency."

Nvidia's Deep Learning Super Sampling is nothing less than revolutionary. In short, it's designed to increase gaming frame rates or allow you to increase your resolution with minimal sacrifices to image quality and latency. It uses everyone's favourite 2023 buzzword – AI – to do it. Now a similar, yet different technology is coming to do the same for streaming video. But while DLSS 3.0 uses game engine data and can generate frames, streaming video

is fundamentally different. Enter VSR.

Nvidia's latest 531.18 driver introduces Video Super Resolution (VSR) for the first time. VSR is able to take low bitrate or low-resolution video and improve its quality. A deep learning algorithm examines each frame in real time and is able to reduce compression-related artefacts, improve clarity or display it at a higher resolution.

For now, the tool works via Google's Chrome or Microsoft's Edge browser. Any online video from 360p to 1440p played

through these browsers can support VSR. Think YouTube, Netflix or Twitch among others. It can also be used for work related purposes like webcam or teleconferencing, delivering clearer and less blocky images.

Why is there a need for VSR? Nvidia claims that 90 percent of all internet video is streamed at 1080p or less, and I'm not going to argue with that. 4K is bandwidth intensive and 1080p isn't going anywhere. On top of that there are internet speed constraints and Wi-Fi congestion issues. The ability to upscale, well, crappy quality video to something slightly less crappy is a welcome feature.

Enabling VSR is dead easy. Just head open the Nvidia Control Panel (usually via right clicking on your desktop) and then navigate to the 'Adjust Video Image Settings' menu and then 'RTX Video Enhancement' menu. VSR has four quality pre-sets, with 1 being the least intensive, and 4 being the most intensive. I had a look to see how it works, and though I only had a short time to play with it, repeating a 1080p YouTube stream with VSR on and off wasn't earth shattering. That's probably an over expectation on my part. It's naturally going to produce better results with lower

bitrate and lower resolution streams.

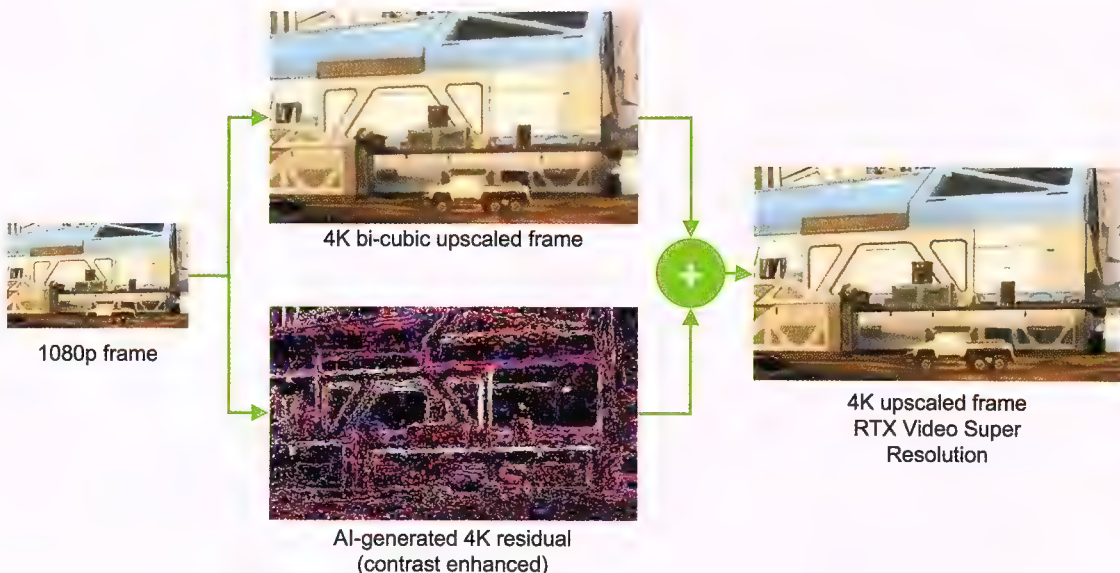
As VSR uses Nvidia's Tensor cores, some increase in GPU utilisation and power consumption is to be expected. It's something to be aware of if you're on your last bar or two of power and weighing up whether to stream just one more Binge episode or not.

It's important not to expect wonders from VSR. It won't magically take a 480p stream and give you 4K OLED TV demonstration-quality video. But I do feel it's a very useful feature and if it's anything like DLSS, it could become an absolute must have in the months and years ahead.

For now, VSR is only supported by desktop and laptop RTX 30 and RTX 40 GPUs. RTX 20 support is coming, but Nvidia hasn't put a timeline on when to expect it. But there's another product that could benefit from VSR, and that's the Nvidia Shield. Even today it's one of the best streaming devices available, and it already includes some of Nvidia's AI know-how. I wouldn't bet against a next generation Shield (or perhaps an Nvidia Tegra-powered Nintendo Switch?) including some kind of AI accelerated VSR tech.

AI is seemingly all pervasive and the boffins are just getting started.

■ Chris Szewczyk



ONE MORE THING

Running an online business

Jon Honeyball wonders if the web designer's day is coming to its end.



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Running a small business isn't easy – I know, I have two of them. My main gig is writing about technology, but the food company that I run with my husband Andre is different. This is public-facing, and it's a lot of work to do marketing, trade and public shows, and operate an e-shop for direct sales to customers.

We have two brands with two websites: Manfood at welovemanfood.com and Janda at jandafood.com. Now, I have been following the rise of e-shopping since its first tentative steps in the mid-1990s. Back in the day, setting up an e-shop was difficult and required a lot of code munging. Better still if you hosted your own server, with a database and a payment gateway. It was a lot of work and a lot of hassle.

Then, in the early 2000s, along came WordPress, and a huge market emerged for that platform. Being an extensible technology, it allowed companies to build all sorts of bolt-on capabilities. We have used WordPress for the Manfood site, including its e-shopping capabilities, and to do this we retained the services of a web design and hosting consultancy.

As a solution it works out reasonably well, but WordPress is not without its issues. Keeping on top of security and updates can be a particular pain. For the Janda refresh, I was conscious that e-shop design and hosting had moved on, with one of the biggest new players being Shopify.

So the obvious thing to do was to reach out to various local web design companies that worked with the Shopify platform. The first came back saying that if we worked with tweaked standard designs, then the cost would be \$7,000. If we wanted more customisation, add another \$3,500 to the bill. The second company's quote was even more eye-watering than our horseradish: "In order to do this we would need to build the core store – \$35,000 – and then build two clone stores which we can swap out the language for \$8,600 each. This would take you to \$52,000."

I took a quick look at the Shopify site and wondered "how hard can it be?" Usually this mindset results in a smoking crater. But over the Christmas shutdown, Andre sat down with his laptop and created an account in Shopify.

Andre is very talented, but a computer geek he is not. He was armed with his M2 MacBook Air, a web browser, a Shopify login and all the background information we had – product details and photography had already been sorted. Four hours later, he showed me the workings of an excellent site. It had everything we needed: product selector, basket, credit card handling and so forth.

So it's now up and running, and has been built for the main part by someone who doesn't understand computers at all well, certainly not at a nerdy level. I needed to step in for 15 minutes to help with the DNS, but this could have been handled by a Shopify-provided DNS name if required. What of security and updates? It's Shopify's responsibility to keep everything up to date. As for the \$50K bill to build a Shopify e-shop for us? Let's just say that we politely declined.

Jon Honeyball ■



Jon Honeyball
Jon Honeyball promises he won't do a SYSKEY on your computer if you email him with your username and password.

"Four hours later, he showed me the workings of an excellent site. It had everything we needed: product selector, basket, credit card handling and so forth."

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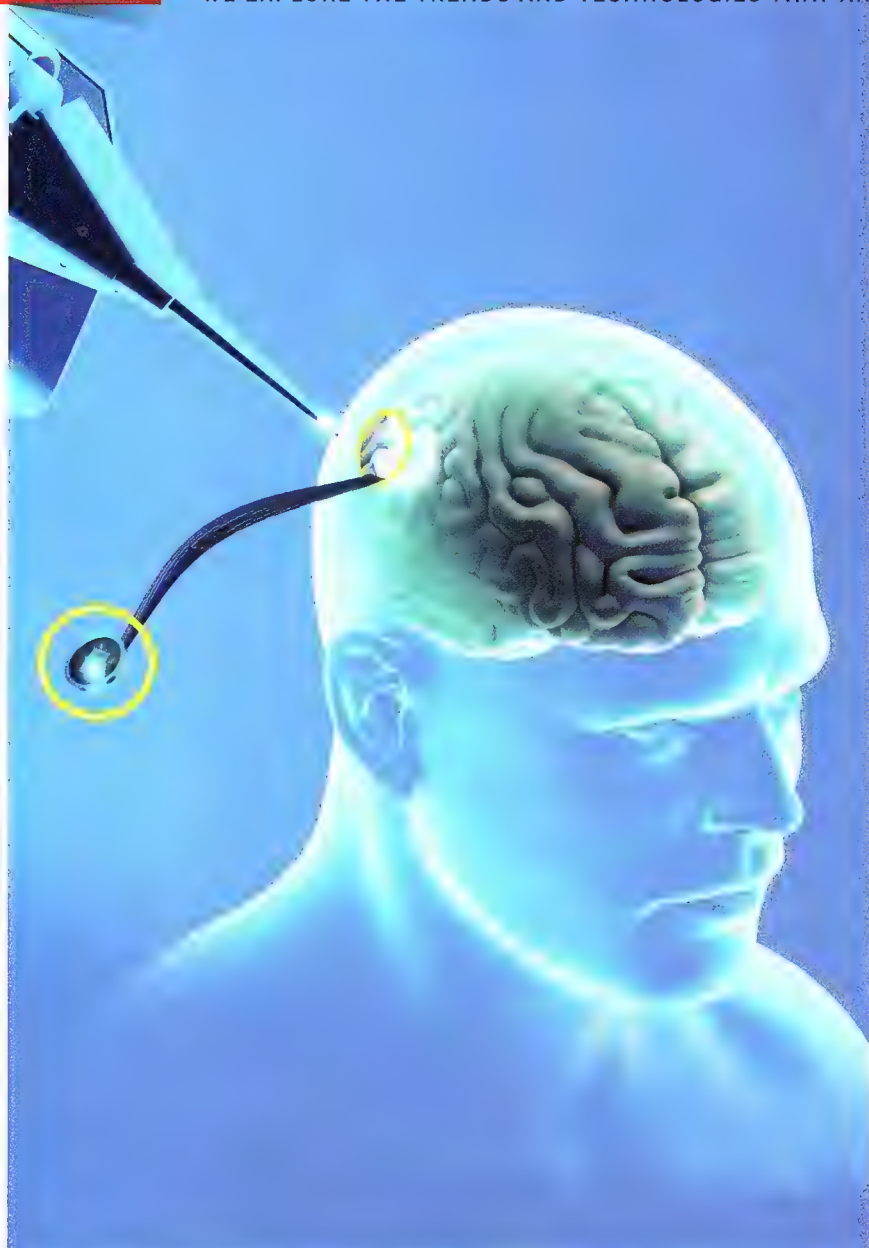
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Neuralink: an old idea that could be the future of medicine

Brain-computer interfaces have long been in the works, but now Musk is applying the accelerator. That could sink his own efforts, but might spur useful research too, finds Nicole Kobie.

A cure for paralysis and blindness that could one day allow humans to level up their own cognition – and all you have to do is trust the tech's most tempestuous CEO to plonk an implant into your brain.

Elon Musk's Neuralink has ambitions as lofty as SpaceX's dream of a mission to Mars and Tesla's fantasy of driverless cars. Founded in 2016, Neuralink is building an implantable brain-computer interface (BCI) that would allow computers to read neural signals. That could, in theory, help anyone suffering paralysis, blindness, dementia or other brain diseases, but Musk also sees the technology as valuable to boost human capabilities. "It's like replacing a piece of your skull with a smartwatch, for lack of a better analogy," he said at a recruitment demonstration known as "Show and Tell" in November.

Neuralink showed attendees a video of monkeys that spelt out the words "welcome to show and tell". The previous year's demo involved a monkey playing a Pong-style game by thinking about moving the controller, while the year before a pig was shown with an embedded implant.

Musk claims the technology will be ready to implant into a human brain within six months, and that he intends to have one surgically shoved into his own skull in a future demonstration. All this is subject to regulatory approval, which in the US is covered by the Food and Drug Administration. "Obviously, we want to be extremely careful and certain that it will work well before putting a device in a human, but we've submitted, I think, most of our paperwork to the FDA," he said. It's worth noting that Neuralink has previously hoped to begin human trials in 2020, and Musk in 2021 said he hoped they'd begin in 2022.

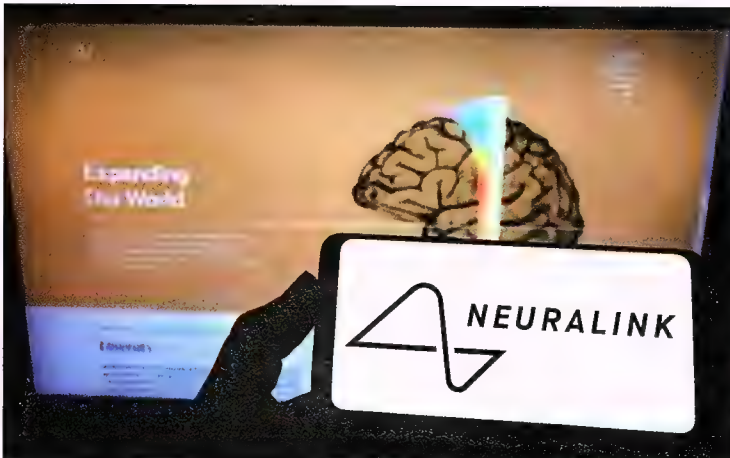
And there's already a challenge to that FDA approval. A complaint has been filed by the Physicians Committee for Responsible Medicine, as well as a federal investigation into animal welfare, sparked by internal staff complaints that the company's rushed development pace is causing unnecessary suffering. Neuralink also faces increasing competition from the likes of Science Corp, which is working to cure blindness, and Synchron, which is hoping to treat paralysis.

Can Neuralink survive these challenges? Is Musk's intensity helping or hindering? Will BCI change lives or remain a dream? Here's what we know.

How it works

At its most basic, Neuralink is a chip that's stitched into the brain with tiny threads that pick up signals. If doctors want to read brain signals now, they attach electrodes to the skull; Neuralink is a miniaturised version that not only reads signals but sends them in order to tell a paralysed limb to move or – perhaps one day – control a smartphone without moving a muscle.

"The basic idea isn't science fiction," noted Andrew Jackson, professor of neural interfaces at Newcastle University. As a neuroscientist with his own neurotech spinout, MintNeuro, Jackson has been controlling animal brains with computers since the early 2000s. "I was building a wearable electronic circuit that sat on the head of a monkey and was connected via electrodes to brain cells," he told APC. "We called it the neurochip back then." The aim was to track brain activity in order to build connections to



Left: Musk claims the Neuralink tech will be ready to implant into a brain within six months. Below: The firm's use of animal testing has raised ethical issues.



prosthetics, and his work has expanded into generating movements as well as suppressing epilepsy seizures.

"I think the thing that people don't often understand... is that this is a concept and an idea that's been around for some time," he said. "And impressive progress has been made."

Indeed, Neuralink's core idea has been demonstrated by researchers since the BrainGate trials in 2009, with implants in humans as early as 2002. And progress has continued, with a trial at Bristol's Southmead Hospital helping to reverse symptoms of Parkinson's in one patient using a deep-brain stimulation device.

Beyond Musk's showmanship and funding, what's different with Neuralink? The form factor, for a start. The BrainGate trial used an implant called a Utah Array, which Jackson describes as a "bed of nails of 100 electrodes". And while it works, that's one of the core limitations to the existing technologies: the implanted electrodes exit through the skin to be plugged into external equipment.

That's the challenge Jackson is trying to solve at MintNeuro, which is working on a wireless design, and the core benefit of Neuralink's design, which is low power and wireless in a tiny package. "What they're doing well is developing low-power wireless interfaces, so you can get rid of the cable through the skin, and making a reasonably small implant package that's connected to lots of flexible electrodes, and speeding up the implantation of the device with surgical robots," he said. "What they're doing is quite sensible."

The biggest hurdles aren't the hardware or the brain science, but

where the two meet. "The challenges are always at the interface – it's where the mushy biology bit meets the fabricated engineering bit," he said. "If you put an electrode into brain tissue you can record nice bright signals on day one, but then over time the quality of those signals sort of deteriorates and might be unstable. That's because of scar tissue building up around the electrodes."

Jackson said that from Neuralink's public presentations, it seems the company may not be fully aware of such challenges, or underappreciates the hurdle they present. "Those are the kinds of things that are much more difficult to solve and the solutions aren't what microelectronics fabrications are used to dealing with," he said.

Jackson cautions that Neuralink hasn't yet released significant details about the hardware itself, with the product presentation actually part of a recruitment day rather than a technology demonstration. "I think the academics among us would prefer that there were scientific papers being published where we could see all of the details, but it's sort of a culture clash," he said. "That's how academics work. But we have to sort of realise that's not how tech companies work."

Reading minds

The tech challenges aren't small – though they are about size. Implants not only need to be tiny to reduce damage to the brain, they also require wireless links to avoid those cables through the skull, draw the lowest power imaginable, be rechargeable and support updates, which Neuralink has said will be possible. "All of that's relatively easy given the kind of sophistication that we have with smartphones," said Jackson.

But challenges remain, particularly with decoding brain signals. It's now easy to train a system to pick up a signal: tell a person to move to the left, or think about moving to the left, and record what their brain does. Eventually, a system can be told to look for that pattern. But what happens when we try to go beyond such simple decoding?

"I think there's a sense within the technology industry that all the problems go away if you can scale up to more and more data," said Jackson. "If you increase the bandwidth of things and increase the number of channels you get a Moore's Law effect and the problems just fall away."

That did work with AI speech recognition, which required tons of training but is now commonplace. But reading more complicated signals, such as complex thoughts beyond "left" or "right", might not work that way. "If we get to the point where enough people have got brain implants and we can get these big data sets, is it going to turn out that the interface that has been trained on someone else's brain or a lot of other people's brains then works for your brain without having to go through a training process?" asked Jackson.

He added: "It's not like I can identify a neuron, a single brain cell, in my brain that's analogous to one in your brain. That's not how brains work... all our brains are different."

What this means is that scaling the technology from simple animal games to mind-reading will take a long time and a lot of effort, and might not even be possible. "We don't know whether it will scale the same way as speech decoding or if it's just a fundamentally different kind of problem... but that's not a reason not to try," he said. "It's an interesting question... and you only find out by getting these kinds of devices into people's brains."

Leadership challenges

The core idea behind Neuralink is sound, which is why others are also developing similar implants. And the technology could be genuinely useful. But Neuralink still faces challenges.

The biggest of all might be Musk. His demand for fast development could be behind those animal testing complaints, with Reuters reporting that staff have suggested the high-pressure environment – in which Musk urged staff to work faster by picturing a bomb strapped to their heads – was leading to fatal mistakes.

Neuralink is reportedly under investigation by the US Department of Agriculture over animal testing complaints. Staff, once again according to Reuters, raised concerns over the pace of testing, saying it was causing unnecessary suffering and even deaths of animals by running trials concurrently rather than one at a time and waiting for results. Further complaints report surgical mistakes causing suffering to animals.

Since 2018, 1,500 animals have been killed in Neuralink testing, though that doesn't necessarily indicate wrongdoing. In response to the accusations, Neuralink has detailed its animal welfare policies, saying it exceeds industry standards. The Physicians Committee for Responsible Medicine has countered that the FDA should investigate. "The company's own employees admit that its botched animal experiments may be suspect to regulators," said Ryan Merkley of the Physicians Committee in a statement.

Musk is famously in a rush – his claims that Tesla's Autopilot mode is fully self-driving are repeatedly



slapped down, even by his own executives – but Neuralink does face rising competition. That said, while founders want their company to become the first to achieve a tech milestone, those awaiting medical help want solutions that work properly – the rest of us are happy for multiple BCI suppliers, so having a robust industry is positive.

Culture clash

As Neuralink is a private firm led by an infamously outspoken individual, there's plenty it doesn't have to share with the rest of us – this is the culture clash that Jackson referred to earlier. While researchers in the field are intrigued to know how the tech works, there is another key question: what's the intent?

We know Neuralink wants to cure blindness and physical paralysis, as well as brain diseases such as Parkinson's. But Musk has also suggested the aim is to enhance humans, perhaps letting those with Neuralink implants "speak" telepathically, control devices with our minds, access

Above: The Neuralink chip is stitched into the brain with tiny threads to pick up signals.

Below: Is research into brain-computer interface technology going too quickly?

memories, and even stream Spotify without headphones.

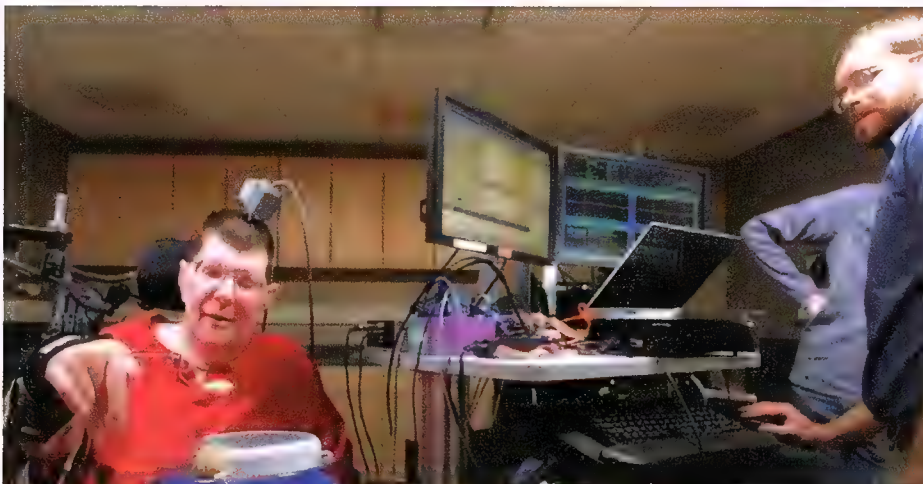
Whether Neuralink is serious about such aims matters, argues Jackson, as it impacts the ethical equation. It's worth testing on animals – or some believe it is – to help reduce human suffering, which is why we allow it for drug development, for example. But if the intent is to avoid putting on headphones, the balance shifts. "If your goal is to develop technologies to help severely disabled people, you can justify putting a device like this into someone's head," said Jackson. "It's more difficult to justify if we're using disabled people as a stepping stone to collect the data sets that we're going to use to develop the next generation of human-enhancement product."

On the other hand, Musk's fast pace of development could be damaging more animals than is necessary, but could also mean quicker progress. Do researchers have a responsibility to work at pace when the goal is reducing human suffering? "There's a balance, and you can go too slowly," Jackson said. "There are people out there who would benefit from his technology, assuming it works and it's safe."

What next?

There's another benefit to Neuralink: it draws attention to the field. The aim of the "show and tell" was recruitment, and shining a light on these technologies could help draw the best and brightest to the field. Jackson says he's already unsure whether to advise students to stay in academia to work on such topics or to find a tech startup – it's hard to see where the most progress will happen. It also draws investors, making it easier for rivals and new startups to find money. "I think it's really great for the field in a lot of ways, but there are also a lot of things that they need to do by the book," Jackson said.

This research is unquestionably not new, and work was progressing before Neuralink joined the crowd. The troubles that follow Musk might distract Neuralink – and attract regulatory attention that derails the firm's work – but the miniaturisation of chips and wireless tech means we're ever closer to the day when someone regains sight or the ability to walk from a brain implant, whether it's made by Neuralink or not. ■



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HOW IT WORKS

GoPro HERO11 Black Mini

In 2022, GoPro released the HERO11 Black and HERO11 Black Mini. With up to 5.3k 60fps and built-in HyperSmooth video stabilisation, the Mini has similar hardware features to its bigger sibling. So, let's look at the inner workings that make this new form possible!

Right: Once opened, the components on the inside of the GoPro camera are easy to replace, but opening it non-destructively is almost impossible.



"The HERO11 Black's Mini-Me gives off a 'back to the roots' vibe - no display for live preview whatsoever. Just a rugged little camera, ready to take a beating."



Above: There are four T4 Torx screws under the lens cover. Sadly, removing them doesn't offer much of a way into the camera.



Above: Heat usually works but when your opponent is a heatsink, things get difficult. Only a trusty Dremel tool can save the day.



Above: As promised by GoPro, it's the same lens and sensor that the company uses in its full-sized HERO11 Black.

Major tech specs

- GoPro's GP2 processor for image processing and stabilisation
- 27.6MP 8:7 1/1.9in sensor with ultra-wide angle lens ($f/2.5$)
- High-res video. Up to 5.3k @60fps and 2.7k @240fps for slow-mo
- 0.5in 72x32px OLED status display
- Waterproof up to 10m
- 133g (21g lighter than the bigger HERO11 Black)

Key findings

- A look under the hood reveals an internal battery, a USB-C port to charge it, and a microSD slot. The lens cover twists right off. Flipping up the Folding Fingers uncovers eight T5 Torx screws. Underneath, there are two more T5 Torx screws but they don't provide access to the GoPro's insides. Sigh!
- All screws come out, but nothing moves, so there must be glue. We use a Dremel and the heatsink lifts off like it was never attached in the first place. Victory at last!
- Three Phillips #000 screws are loosened to remove the flexible circuit board (FPC) from the heatsink. Underneath sits the speaker for the camera's sound. Located between two mounting holes is the GoPro's rear-facing MEMS microphone.
- The battery can now be unplugged. After that, it takes just one T4 Torx screw to loosen the battery tray and pull the 1500mAh Li-Ion cell out of the case. An internal battery for a camera that is virtually impossible to open non-destructively? Not nice!
- To free the mainboard, we unplug the connector for the sensor and remove the four Phillips screws, only to find it's a rigid-flex PCB and realise that the other part is buried even deeper.
- After peeling back some tape, there's one more Phillips #000 screw and the USB port assembly can be pulled out of the body. With the mainboard unobstructed, it reveals that the MicroSD slot is soldered directly to the second part of the mainboard.
- With the connectors unclipped, removing the FPC uncovers a Phillips #000 screw and the mainboard is freed. We unclip the EMI shields and remove the thermal paste to see a GoPro GP2 processor, Samsung 8GB eMMC memory, Qorvo power management, a microSD connector, and an STM microcontroller.
- Next up is unclipping the sensor's EMI shield, removing some tape and lifting the latch that keeps the FPC in place, and removing three 1.3mm hex screws that secure the lens.
- The PCB is rather unspectacular but at the top, we can spot a significant contributor to GoPro's HyperSmooth stabilisation, the Bosch BMI260 inertial measurement unit. "Are we there yet?" Not quite. There are two more Phillips #000 screws before we get a glimpse of the Mini's secondary PCB.
- On the top side, there is a GoPro's shutter button, a 0.5in 72x32px OLED display, and a Seiko ML414H backup battery. The bottom side is no less exciting. We find a Qualcomm QCA9377 WiFi and Bluetooth chipset and a top-facing MEMS microphone.
- Four T4 Torx screws hold the aluminum bracket in place. Lifting the metal frame out of the case reveals a power/pairing button and, on the bottom side, a front-facing MEMS microphone.
- Repairability Score: 2/10 (10 is easiest to repair). The lens cover can be twisted off and replaced. But the elephant in the room is the non-removable battery. Once open, components are easy to replace but opening it non-destructively is near-impossible. ■

ABOUT IFIXIT

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit www.ifixit.com

THE A-LIST

The A-List

The best products on the market, as picked by our editors.

FIND THE BEST DEALS ON NEW GEAR AT [GETPRICE.COM/AU](https://getprice.com/au)

PREMIUM LAPTOPS

■ NEW ENTRY

APPLE MACBOOK PRO 16IN (M2)

STUNNING CREATIVE POWER

All the upgrades to this 2023 model are within, as Apple's M2 Pro and M2 Max processors take charge. Combine this power with the 16.2in mini-LED screen, superb sound system and phenomenal battery life, and you have the world's premier workstation laptop.

From \$3,199, apple.com/au



ALTERNATIVES

DELL XPS 15 (2022)

Surely the best Windows all-rounder money can buy, with a slim design, gaming potential and plenty of power courtesy of Intel's 12th gen Core processors.

From \$2,924, dell.com

APPLE MACBOOK AIR

The MacBook Air M2 looks like a standout to us. A powerful and quiet ultraportable with an unbeatable battery life and a great pro display.

From \$1,899, apple.com/au

MICROSOFT SURFACE PRO 9

APC rates the Intel model highly, the SQ3 model less so. With Intel, you get a solid upgrade to the world's leading detachable tablet laptop.

\$2,549, microsoft.com

BUSINESS LAPTOPS

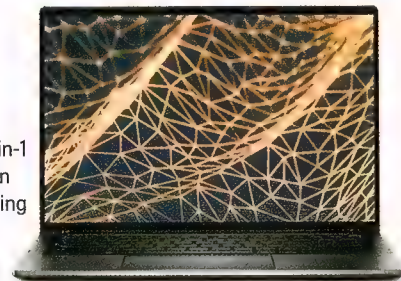
■ NEW ENTRY

Dell Latitude 9330 2-in-1

FLEXIBLE BRILLIANCE

This is a brilliantly made 2-in-1 that's flexible both in design and configuration. Everything screams quality, from the wide-gamut 13.3in matte screen to the enhanced features for Zoom calls – including a superb 1080p webcam, mics and speakers.

\$5,031, dell.com/en-au



ALTERNATIVES

■ NEW ENTRY

LENOVO THINKPAD T14 GEN 3 (INTEL)

An awesome keyboard, slim design, customisable spec and fine selection of ports make this a great business laptop.

\$2,529, lenovo.com/au

■ NEW ENTRY

ACER TRAVELMATE P6

Not the most powerful due its 11th gen Core chip, but a great 14in screen and keyboard, superb battery life and competitive price lift it above rivals.

\$2,799, acer.com

■ NEW ENTRY

DYNABOOK PORTEGE X40L-K-101

A simply brilliant 1kg 14in laptop that excels in all areas, including superb battery life. Buy the K-105 for \$2,193 if you can live with a Core i5 processor.

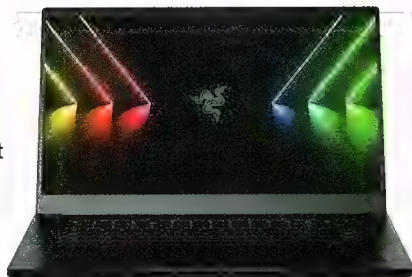
\$2,543, anz.dynabook.com

GAMING LAPTOPS

RAZER BLADE 15 (2022)

A SUPERBLY ENGINEERED GAMING POWERHOUSE

Right now there's just not another better gaming unit around. It's miraculously thin considering the beefy components inside, thermals are very well managed and the Razer Blade 15 manages to extract very good performance from its GPU without undue throttling. There are many variants and options, and they're an outstanding buy if you find one on sale. ~\$4,499, razer.com/au-en



ALTERNATIVES

LENOVO LEGION 5I PRO (16IN)

A great-value gaming laptop that's extracts the most from its powerful components. We really love the keyboard, too.

From \$2,649, lenovo.com/au

AORUS 17

If you're after a device to seriously game on, and you don't care about the bells and whistles then this is a great option that cuts costs in all the right places.

\$3,699, gigabyte.com

ASUS ROG ZEPHYRUS G14 (2022)

A powerful gaming ultraportable that lights up for both work and play. The AMD CPU and GPU balance well.

\$3,99, asus.com/au

EVERYDAY LAPTOPS

MICROSOFT SURFACE LAPTOP GO 2

FEELS LIKE A PREMIUM ULTRABOOK, BUT COSTS HALF AS MUCH.

A solid update to an amazingly good value mid range ultrabook. It runs cool and quiet, and has up to 30 percent better battery performance than its predecessor, all in a beautifully designed form with a superb keyboard and trackpad.

From \$1,099, microsoft.com/en-au



ALTERNATIVES

LENOVO YOGA SLIM 7 PRO

A powerful, well designed ultrabook with an awesome OLED screen for a good price. The original 2-in-1 bends into a new clamshell shape.

\$1,699, lenovo.com

HP ENVY 13 (2020)

It may not be the world's most exciting laptop, but the Envy 13 is a compact and forward-looking machine that's ideally suited to these homeworking times.

\$1,699, store.hp.com

HP PAVILION 14

This slim 1.4kg laptop is a superb choice for anyone on a tighter budget. It struck an excellent balance between speed and battery life – around ten hours.

From \$999, store.hp.com

CHROMEBOOKS

ASUS CHROMEBOOK FLIP CX5

The best big-screen Chromebook we've tried, with a bright 15.6in Full HD display with decent black levels and surprisingly rich colours. And it's a good specification for the price, with a Core i3 processor, 8GB of RAM and a 128GB SSD in tow. \$1,213, asus.com/au



LENOVO FLEX 3 CHROMEBOOK

This isn't the most powerful Chromebook, but students need reliability more than power – especially if they're only really using it for homework, note-taking, and perhaps the occasional bit of Netflix. \$484, lenovo.com/au

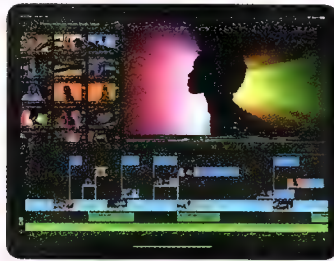
LENOVO IDEAPAD DUET

The Chromebook answer to Microsoft's Surface tablets, this is a seriously versatile device – albeit not the speediest (although we never found it to be painfully slow while carrying out everyday tasks). For this price, and with a 16hrs 14mins battery life, the Duet is a great choice. \$899, lenovo.com/au

TABLETS

APPLE IPAD PRO 12.9IN (2021)

M1 POWER IN YOUR PALM FROM \$1,199
Blurring the boundaries between laptop and tablet like never before, the M1-powered iPad Pro 12.9-inch is every bit as fast as we expected – and the "Liquid Retina XDR" display is simply phenomenal. From \$1,649, apple.com/au



APPLE IPAD (2021)

Apple performs its usual trick of upgrading just enough to keep the iPad affordable and up to date, without treading on the toes of its more luxurious stablemates. The big bezels remain, but a faster processor, more storage and improved camera all add to its appeal. From \$499, apple.com/au

SAMSUNG GALAXY S8 ULTRA

The Samsung Galaxy Tab S8 Ultra is an enormously impressive tablet. It makes a fantastic first impression with its gorgeous screen and thin body, and is great for multitasking. If you want the best Android tablet going, there's no question at all that this is it. \$1,499, samsung.com

EVERYDAY MONITORS

PHILIPS BRILLIANCE 346P1C

34-INCH CURVED DOCKING, No-one can match Philips for its mix of quality, features and value, especially when it comes to curved MVA monitors such as this. It's great for casual gamers and busy workers alike, with USB-C docking and superb colours. \$849, philips.com.au



EIZO FLEXSCAN EV2480

Businesses in particular will love this easy-to-roll-out 24-inch monitor, with its exceptional five-year warranty, USB-C port for easy docking, excellent viewing angles and delicious whites. And it has the best OSD around. \$699, eizoglobal.com

DAHUA DHI-LM28-F420

This affordable 4K monitor might not offer much in the way of menu options or high-end gaming perks, but it offers impressive resolution and colour for ally pay. \$269, dahuaaustralia.com.au

PROFESSIONAL MONITORS

EIZO COLOREDGE CG319X

CREATIVE MASTERCLASS, \$7,119
As the price indicates, this monitor is for heavyweight creatives who demand the best in every discipline: HDR video editing, print layouts, professional photography and more besides. With superb coverage and accuracy across all spaces, plus a built-in calibrator, it justifies the investment. \$7,119, eizoglobal.com



BENQ PD2725U

By no means a cheap 4K 27-inch monitor – unless you compare it to the Eizos – but it marries all-round quality with ease of use thanks to a puck that allows you to quickly move between settings. You can even daisy chain a second Thunderbolt 3 monitor for a monster setup. \$1,799, benq.com

EIZO COLOREDGE CG279X

Designers who need to work across different disciplines will love how easy it is to switch between the Adobe RGB, DCI-P3 and sRGB colour spaces using the Eizo's fantastic OSD. It's certainly not cheap for a 27-inch 1440p monitor, but it's packed with quality. \$3,095, eizoglobal.com

HOME OFFICE PRINTERS

EPSON ECOTANK ET-1810

BACK TO BASICS
There's nothing flashy about this bottle-fed inkjet: it's there to churn out pages at a decent rate (8.8ppm for black text) for a low price. It comes with enough ink for 4,500 black pages and 7,500 in colour, but refills are cheap. Just don't expect features like duplex printing. \$299, epson.com.au



CANON PIXMA PRO-200

Yes, it's big and it's expensive – and you don't even get a scanner – but the Pixma Pro-200 means that you can print A3 photos with glorious colour accuracy and detail. If you're after an office workhorse, look elsewhere, but it can't be beaten on photo quality. \$809, canon.com

BROTHER MFC-J4540DWXL

Home workers will love this inkjet all-in-one. It combines an incredible range of features with all the connectivity you need and extreme ease of use. Output quality is fine, it offers the best cloud support around and the high-capacity ink pack could keep you going for years. \$420, brother.com

WIRELESS ROUTERS

SYNOLOGY WRX560**THE PERFECT ROUTER**

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\$599, synology.com/au



■ NEW ENTRY

ASUS ROG RAPTURE GT-AX16000

The most splendid, overpowered router on the market. But, it's silly money and aspirational to most users. Ultimately, though, it's currently the highest-spec consumer router available.

\$1,299, asus.com/au

SYNOLOGY RT6600AX

Fast, well-featured and secure, the Synology RT6600ax is as perfect for professionals and prosumers as much as it is for SMBs and smart homes, and the app and interface are a delight to use for both experts and plug and play users alike.

\$599, synology.com/au

MESH WI-FI

TP-LINK DECO XE75 AXE5400**SUPERB WI-FI 6 MESH**

Offers the simplicity, speed and range most people want from a mesh system. While it's expensive, nothing else offers the plug-and-play simplicity, speed and range afforded by the Deco XE75.

\$999, tp-link.com

**TP-LINK DECO X20**

The price below isn't a typo: the Deco X20 makes it possible to upgrade your home network to Wi-Fi 6 – as well as manage its security – for the price of some standalone routers. The included HomeCare functions are also a great bonus for households where lots of devices are fighting over the bandwidth.

\$199, tp-link.com

ASUS ZENWIFI AX

The interface and design certainly aren't the prettiest (the nodes look like mini space heaters, while the charcoal version is straight out of the 1980s), but if you're after strong performance, great features and plenty of expansion potential, the ZenWiFi AX is a compelling prospect.

\$949, asus.com/au

NAS SERVERS

QNAP TS-130**SIMPLE HOME NAS**

An above average CPU and RAM combo, solid features and affordable price make the QNAP TS-130 worth considering. Alternatively there's the two bay TS230 which features the same CPU, with 2GB of RAM, dual drive bays, and an extra USB port on the front for a modest \$50 price increase.

\$250, qnap.com

**ASUSTOR NIMBUSTOR AS5304T**

This is a hugely powerful four-bay NAS that will be overkill for most people – not just due to its speed but also its slightly intimidating user interface – but techies and gamers should investigate the Nimbustor AS5304T for both its speed and flexibility.

\$799, asustor.com

SYNOLOGY DISKSTATION DS1522+

At \$1,199 it's not cheap but factoring in the software means it's great value. Though some internal silicon may lack headroom, this is still a well-featured, expandable NAS with fantastic software. The best part is the DSM software.

\$1,199, synology.com

SECURITY SOFTWARE

F-SECURE SAFE

F-Secure concentrates on the basics: faultless protection with minimal impact on your system's performance – for a low price. 1-3 PCs, 1yr, \$99.99, f-secure.com



ALTERNATIVES

NORTON 360

Consistently on the podium in our group tests, and loaded with an abundance of genuinely useful features, including a VPN and generous cloud backup.

1 PC, 1yr, \$79.99, nortonlifelockpartner.com

AVAST FREE ANTIVIRUS

For the second year running, Avast is our top pick for free antivirus software – it's simply lighter on its feet than Microsoft Windows Security, whilst offering fewer false positives.

Free, avast.com

VPNs

NORDVPN

NordVPN provides consistent and fast speeds, serious security, great support for video-streaming services and some cost-effective subscription rates. \$59 per year, nordvpn.com



ALTERNATIVES

PROTONVPN

ProtonVPN provided one of the best free offerings of all the VPNs in our group test, including unlimited data, but upgrade to benefit from even faster speeds and many more options. Free, protonvpn.com

SURFSHARK

A strong rival to NordVPN, especially if you're willing to commit to its two-year contract. It's fast, cheap and a fine choice for people who like to switch to US streaming services. \$66.34 for one year, surfshark.com

PASSWORD MANAGERS

BITWARDEN

Bitwarden has a huge advantage: it's free. It isn't as slick as some paid-for rivals, but it can sync passwords across all devices for no extra charge. Free, bitwarden.com



ALTERNATIVES

DASHLANE

A manager that's ideal for beginners, and it even builds in an unlimited (if basic) VPN service. Note you may prefer to buy the Family plan (\$60 per year) as this extends the service to six people. \$55.99 per year (Premium), dashlane.com

1PASSWORD

1Password is targeted at technically minded users who are looking for the last word in security. It even offers a Travel Mode that may ease your mind if surrendering your phone to customs officials. \$54.99 per year (individual), 1password.com

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Online Interactivity

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TECHNOTES

Gadgets

Tricky devices.

1

VICTROLA STREAM ONYX

A turntable that connects to your multi-room sound system.

US\$599 | victrola.com



Sonos has traditionally required you to use one of its amps or particular speakers that allowed you to plug in stereo audio cables in order to interface with vinyl turntables, but a new deck from Victrola will allow you to wirelessly connect to your multi-room Sonos system. The Stream Onyx connects to your multi room system through the Victrola Stream app finally bridging a gap that's existed for a while now. The Victrola team released the Stream Carbon last year with a similar feature set, but the new Stream Onyx should be quite a bit cheaper without losing too much fidelity.

2

APPLE HOME POD GEN 2

Better sound at a lower price.

\$479 | apple.com/au

The Apple Home Pod Gen 2 doesn't look overly different from its predecessor, but it has seen a pretty big improvement in overall sound quality and a slight reduction in price. The \$479 smart speaker now contains five higher performing tweeters that offer notably better sound especially when two are paired as a stereo system and the automatic self adjusting audio microphones do a great job of tweaking the sound to improve audio quality. The device also offers built-in temperature and humidity sensors so it's better equipped to answer just how hot it is.





3 VAGABUND MOTO FREERIDE E

The electric motorbike you want in the post-apocalypse.

€19,900 | vgb-essentials.com

There's some amazingly cool looking e-bikes coming out these days, but few have the power and full-future aesthetics as the Vagabund Moto Freeride E. This Austrian design studio used the popular 2022 KTM E-CX electric dirt bike as a starting point and hammered it into a polished futuristic device that would look as slick in any forward thinking metropolis as it would dodging sustainably grown pine trees on dirt trails. A brushless 18kW synchronous motor provides 42Nm of torque to get you up to speed really quickly. Definitely not the cheapest e-bike around, but these are basically a bespoke bike that look unlike anything else available.

4 FARO UNIT 1 SMART HELMET

A smart helmet that has your back if you get into trouble.

€249.80 | unit1gear.com

The super successful Faro helmet Kickstarter has transformed into a fully-fledged product over the last year and is now available to buy directly from the company. This clever helmet is able to signal where you're headed to traffic and includes a full set of visibility lights to ensure you never go unseen. In addition to offering advanced features like a braking light, the device also had a Mips safety system installed to alert emergency services if you've had an accident and can't do so yourself. If all that wasn't enough, it's actually also just one of the better looking helmets you can get your hands on.

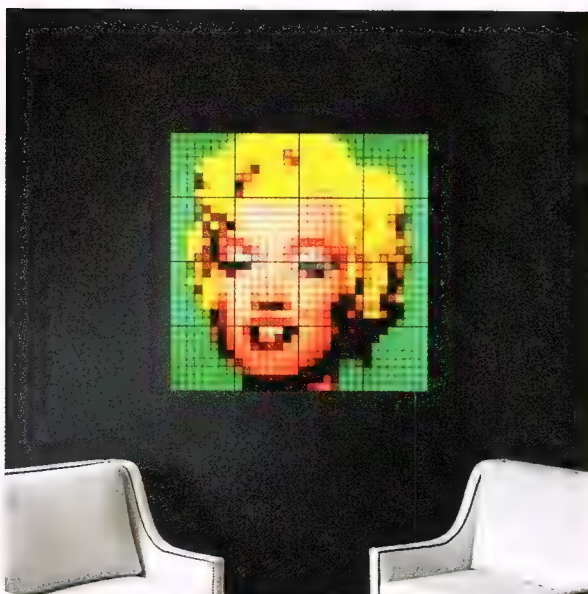


5 TWINKLY SQUARES

Twinkle twinkle little square.

\$452 | twinkly.com/en-au

If you like the idea of Nanoleaf, but wish you could customise the light into images and artworks of your choosing, then you might just prefer the Squares Smart LED wall panels. The app controlled smart panels allow you to customise your own image or moving images and the pixelated design means it's easier to add custom visuals that translate well on the wall. At \$452 they're not the cheapest light kit for your home office, but they're super modular and will let you upload NFTs or sync to your current games and music.



LAPTOP

Apple MacBook Pro 14 & 16-in (M2 Pro or Max)

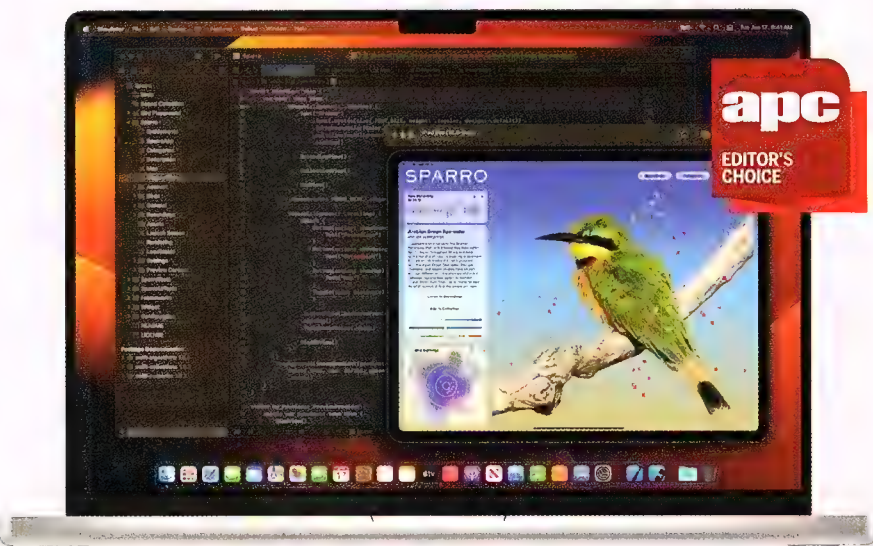
Can the next generation of Apple silicon keep the MBP in the MVP spot?

■ From \$3,199 | apple.com/au

Unlike the MacBook Air range, the new M2 updates of the MacBook Pro 14 and 16 inch laptops aren't massively different to their predecessors. Obviously the devices come with new M2 Pro or M2 Max processors, which will bring respectable upgrades to overall performance, but other than this the devices only really get new Wi-Fi 6E networking capabilities, a new Thunderbolt spec, a faster AI chip and greater memory bandwidth.

This isn't a complaint, the 14.2-inch or 16.2-inch Liquid Retina XDR displays are still top of their game with high 3K-plus pixel resolutions, bright 1000 nit sustained screen brightness, 120Hz dynamic refresh rates and full DCI-P3 colour reproduction capabilities. There's really not much more that you can get in a top shelf laptop screen. The devices also offer industry leading SSD disk speed tests at 7,700/5,727 MB/s read and write speeds, respectively, and you've got a wide range of interface options including an HDMI and an SD Card reader, so you really don't have to sacrifice anything.

One of the top line features of the 2023 MacBook Pros is a faster memory interface with greater bandwidth, so it makes sense that Apple sent us a top of the line MacBook Pro 16 with 96GB of RAM and an 8TB SSD that retails for \$10,099. Obviously this extremely highly specced unit is not going to be for everyone, but the entry level 14 and 16 inch devices start at \$3,199 and \$3,999 respectively. This much more approachable price point will net you a device with a M2 Pro chip, consisting of



■ MacOS Ventura; 16.2-inch Liquid Retina XDR Display at 3456x2234 pixel resolution, 120 HZ VRR, 1600nit peak brightness, DCI-P3 colour; Apple M2 Max 12-core CPU, 38-core GPU, 16-core Neural Engine; 96GB Unified Memory; 8TB SSD; 100Wh battery (20h20min 1080p movie playback); 35.6 x 24.8 x 1.7cm; 2.16kg.

a 10 or 12-core CPU, 16 or 19-core GPU and a 16 Core Neural Engine; 16GB of Unified Memory; and a 512GB SSD. If we look at offerings from Razer and Dell these entry level units are by no means underpowered and offer competitive advantages over both the Blade 15 and XPS 15 devices.

Apple has made strides towards greater engagement with the gaming community and it's about to get a native version of *No Man's Sky*, but if that's an important component in what you're looking for the faster refresh rates and gaming specific GPU of the Razer Blade 15 is still definitely where you should put

your money. That said, for anyone predominantly looking to use their laptop for work, especially graphically demanding creative work, the MacBook Pro's ability to share memory between CPU and GPU and the generous battery capable of reaching peak performance without attached power are some pretty convincing drawcards.

This battery lasted over 20 hours in our 1080p movie playback benchmark and Apple claims you'll get 12 or 15 hours of browser based work from the 14 and 16 inch devices, respectively. That's well over what you'd really need for a remote work day and should include enough overhead to actually do some demanding creative work while on the go, which is something that isn't offered by other professional laptops on the market.

Add to this the 19 percent CPU performance bump and up to 29 percent graphical improvement of the M2 Max over the M1 Max and you have a well rounded set of upgrades that will be appealing to anyone in the market for a new top shelf laptop for creative professionals.

Improved performance, amazing screen and unbeatable battery life make this a desirable pro laptop.

Joel Burgess

★★★★★

"One of the top line features of the 2023 MacBook Pros is a faster memory interface with greater bandwidth."

	MacBook Pro 16 M2 Max	Apple MacBook Pro 16 M1 Max
Geekbench 5 - Single-core (score)	2,043	1,775
Geekbench 5 - Multi-core (score)	15,129	12,709
Cinebench R23 - CPU (multi-threaded)	14,661	12,384
Geekbench 5 - OpenCL (score)	17,966	60,630
Sid Meier's Civilization VI - 1080p Ultra (FPS)	68	50
Battery life - 1080p video playback (h:min)	20h20min	9h6min
BlackMagic Disk Read (MB/s)	7,741	6,278
BlackMagic Disk Write (MB/s)	5,727	5,318

2-IN-1 LAPTOP

Asus Zenbook 17 Fold OLED UX9702AA

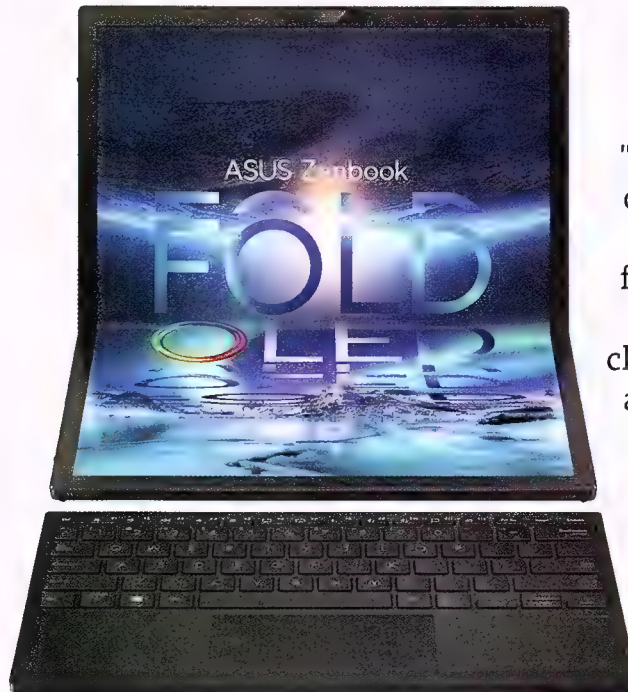
Are flexible screens the future of laptops or just a fad destined to fold?

■ \$6,999 | asus.com

Tech companies need to break new ground to get a headstart in new markets, but anyone who has been in the game a while knows that it's extremely risky to be the first to market with a radically different device. Asus has been toying with alternate laptop screen designs for ages now, and it has some pretty unique laptop offerings that work really well as a result of that, but the Asus Zenbook 17 Fold OLED is, arguably, its biggest and boldest step into novel laptop technology.

On paper the idea of a 17-inch laptop screen that can fold into a 13-inch-ish form factor clamshell is a pretty amazing concept. And the Asus Zenbook 17 Fold OLED can do exactly this, folding perfectly in half to a neat package of 28.5 by 19.5cm, which is within about a centimetre off the footprint of a 13-inch XPS 2-in-1. The folding OLED panel isn't able to fold flat on itself so there's a bit of curvature at the bendy end that adds thickness, but the accompanying Bluetooth keyboard that magnetically attaches to the bottom half half of the screen fills that display gap thickness to make the device more sturdy.

The device works well in the traditional laptop position sitting on top of the bottom half of the display and you can unfold the 11-ish-inch display into its full 17-inch extended form and prop it up with the inbuilt kickstand while you use the Bluetooth keyboard. This is where the device becomes a really unique offering, since you can utilise a giant screen with impressive colours and deep blackness levels that is great for media playback and work tasks. The sound is louder than what you might expect, and there's enough battery in either display mode to allow you to work



"On paper the idea of a 17-inch laptop screen that can fold into a 13-inch-ish form factor clamshell is a pretty amazing concept"

■ W11 Home; 17.3-inch 60Hz 500nit OLED display at 2560 x 1920 pixel resolution, DCI-P3 colour; Intel Core i7-1250U CPU; Intel Iris Xe GPU; 16GB RAM; 1TB SSD; 75Wh battery (12h32min 1080p movie playback); 37.8 x 28.7 x 3.3cm; 1.8kg (with keyboard).

without power for an average work day.

While there are many ways in which this device is exceptional, it's also got some major limitations. The first is that while this device offers an unusually large screen, it's paired with one of Intel's lighter U series 12th Gen processors, the i7-1250U. This processor is more than fit for purpose, offering solid boost speeds that make it able to keep up with anything you throw at it for short periods, but it is only around half as powerful as top spec'd MacBook Pro models and more than 30-percent behind 12th gen H series i7 chips in

many benchmarks.

The Bluetooth keyboard could also use some refinement since the connection can make the trackpad and cursor feel a bit delayed and you have to independently charge it. The laptop is also over 3cm thick when folded with the keyboard and the gloss coating on the screen isn't great in brighter environments, showing a lot of reflection.

The main limitation however is the price. When you can get a 16.2-inch MacBook Pro with a M2 Max processor, 2TB SSD and 64GB of memory for a similar price, or a Razer Blade 15 with a 3080 Ti GPU for less, the novelty of having a slightly larger screen that folds doesn't seem like enough of a drawcard to pull you away from the best laptops. Maybe in a generation or two this could be the device to beat, but at present, there's still a few too many kinks for a \$7K laptop.

	Asus Zenbook 17 OLED Fold	Razer Blade 15 (2022)
PCMark 10 - Overall (score)	4,310	7,126
Geekbench 5 - Multi-core (score)	6,598	10,093
Cinebench R23 - CPU (multi-threaded)	6,749	10,796
3DMark - Time Spy (score)	875	9,950
Geekbench 5 - Open GL (score)	14,576	136,521
Battery life - 1080p video playback (h:min)	12h32min	4h54min
CrystalDiskMark Read (MB/s)	7,010	6,907
CrystalDiskMark Write (MB/s)	5,263	4,951

Expensive new screen tech that could very well be the next growth segment in laptops.

Joel Burgess

★★★★☆

PC

Intel NUC 12 Pro

Intel's NUC 12 Pro is a Windows-based Mac Mini that's open for business.

■ \$1,059 | intel.com.au



It wasn't that long ago that we covered Intel's NUC 13 Extreme compact gaming PC kit launch, but in 2022 the company launched an even more compact version for people who wanted a business-style device. The reduced demands of a standard workload means that the Intel NUC Pro can fit into a 12-by-12cm chassis that's just under 4cm tall and weighs about 450g. That's notably smaller than the 19cm squared, 1.18kg Apple Mac Mini, which is an impressive feat on its own, but it's also competitively priced.

Unlike its gaming sibling, there's actually a wide variety of NUC 12 Pro PCs on offer ranging from a Barebone i3-1220P kit that requires you to add your own RAM and storage for \$499 to an i7-1260P system with 64GB of RAM and a 2TB SSD for \$1,479. Intel sent us a mid-range unit with an i7-1260P, 16GB of RAM and a 500GB SSD which can be picked up for around \$1,059.

■ Windows 11 Pro; Intel Core i7-1260P CPU; Intel Iris Xe Graphics; 16GB RAM; 500GB PCIe SSD; 11.7 x 11.2 x 3.7cm; 450g.

This is a nicely balanced device with enough storage to not require constant optimisation and the i7-1260P is a powerful chip that will be more than enough for the majority of workloads. Combine this with 16GB of RAM and you'll have no problem with photo editing, light video and any of the more standard office applications while you're running a bunch of browser tabs. This processor was even able to outpace the standard Apple M2 chip on highly multi-threaded rendering tasks like Cinebench.

The graphics capabilities on the other hand are about 35-percent behind what you'll get on a standard M2 Mac Mini, so it's not quite up to entry level gaming for modern games, but that's still enough to

do light graphical work and play older titles at low settings.

These PCs have been designed for business use so there's a number of enterprise features enabled that makes it easy for IT managers to allow remote access and application monitoring. Most of these features won't be overly useful for your average user, but the optional Intel vPro platform does reportedly use a more stable system to make it less likely for you to run into issues that can hinder productivity.

The compact device has ample connectivity options with multiple HDMI 2.1 ports, 2 Thunderbolt 4 connections, Ethernet, 3.5mm audio and a bunch of USB-A connections, to ensure you can easily do or see whatever you need to.

This inoffensive small black box will be more than enough for most workers' needs and while it might not be particularly imposing as it is, the unit also comes with a mounting bracket that'll allow you to attach it to the back of a monitor or a wall to give you an even more streamlined workspace.

	Intel NUC 12 Pro	Apple MacBook Air (M2) Mid-2022
Geekbench 5 - Multi-core (score)	9,387	8,896
Geekbench 5 - Single core (score)	1,748	1,893
Cinebench R23 - CPU (multi-core)	11,562	8,481
Cinebench R32 - CPU (Single core)	1,769	1,599
Peak CPU temperature (°C)	100	Not tested
Geekbench 5 - Open CL (Score)	17,921	27,637
3DMark - Time Spy (Score)	1,790	Not tested
CrystalDiskMark Read (MB/s)	3,555	3,063
CrystalDiskMark Write (MB/s)	2,526	2,873

A compact work PC with business perks at a fair price.

Joel Burgess

★★★★★

GRAPHICS CARD

Asus ROG Strix GeForce RTX 4070 Ti OC

A 4070 Ti with all the trimmings.

■ \$1,849 | www.asus.com



■ Asus ROG Strix GeForce RTX 4070 Ti 12GB OC Edition; 7680 CUDA cores; 2760MHz boost clock; 12GB GDDR6X 21Gbps memory, 504.2GB/s memory bandwidth; 3x DisplayPort 1.4a, 2x HDMI 2.1; 285W TDP, 1x 16-Pin power connector.

4080 and 4090 class cards are, but it's close enough. It takes up 3.15 slots – effectively four, so it's not one for a small form factor build. But a big card means lots of heatsink surface area, and the Asus runs cool with a recorded load temperature of just 64 degrees. That's a good result, because it's achieved with essentially no fan noise.

The RTX 4070 Ti is a very good card for a high refresh rate 1440p screen. It beats out the RTX 3080 Ti – which is no mean feat, while offering far superior ray tracing capabilities. That's before enabling DLSS, which in our opinion is

Nvidia's killer feature. The 4070 Ti does run into limitations at 4K, surely due to memory bandwidth limitations, although it's still a capable 4K card in most instances. The Asus Strix happily keeps pace with other high end 4070 Ti's while remaining silent.

In just about every GPU review over the last few years, we spend too much time lamenting about prices. If a \$1,500 'entry-level' RTX 4070 Ti is too much, then the Asus, at over \$1,800 is a really tough ask. Some people will happily pay a bit extra for the Asus name, and there's nothing wrong with that. You'll get a card that's premium by every measure. But if it was our money, we'd be inclined to go with the Asus TUF model for a few hundred dollars less. It may not have the ultra-premium design of the Strix, but in this economy, a few hundred can make a big difference. We can only hope the Strix and all 4070 Ti cards in general drop to levels that are more enticing for gamers that will never pay \$1,500+ for a graphics card.

The Asus Strix is a fine example of an RTX 4070 Ti, but its price relative to Asus' own TUF 4070 Ti is too much of an ask.

Chris Szewczyk

★★★★☆

If you're after the best example of any given GPU, Asus' ROG Strix cards must come into the discussion. Though they often attract a price premium, at least you know you'll be getting a product that's truly flagship tier.

The RTX 4070 Ti is the third Ada Lovelace card to be released, and it's a good GPU. Sadly – it's marred by high pricing. It's built on the AD104 4nm GPU with all of its features enabled, including 7,680 cores, 60 RT Cores and 240 Tensor Cores. The boost clock of the ROG Strix RTX 4070 Ti is 2,760MHz, a sizable increase of 150MHz over the Nvidia reference speed. You can reliably set it to a very impressive 2,790MHz with one click via Asus' GPU Tweak app.

It includes 12GB of 21Gbps GDDR6X memory connected to a 192-bit bus. It's difficult to get used to a skinny 192-bit memory interface on a card that costs close enough to two grand! Its TDP is a very reasonable 285W, with power provided by a single 16-pin 12VHPWR power connector. Asus adds a second HDMI 2.1 port, giving it a total of three DP 1.4 ports and two HDMI 2.1 ports.

Asus sets the Strix apart with an excellent PCB that's unchallenged by the AD104 GPU – even when heavily overclocked. You get dual BIOS, attractive ARGB lighting and a very useful pair of 4-pin fan headers which can be used to control adjacent case fans. These can be set to ramp up with GPU temperatures.

As if you didn't know it, the Strix is a big card. It's not quite the hulk that

			Asus ROG Strix GeForce RTX 4070 Ti	Nvidia GeForce RTX 3080 Ti	AMD Radeon RX 7900 XT
Metro: Exodus Enhanced Edition	2560x1440 Extreme Preset	Min	51.6	48.0	47.4
		Avg	74.7	67.0	65.5
	3840x2160 Extreme Preset	Min	31.8	29.0	28.3
		Avg	42.3	39.0	36.0
Cyberpunk 2077	2560x1440 RT Medium Preset	Min	48.8	49.5	26.6
		Avg	59.7	60.4	50.1
	3840x2160 RT Medium Preset	Min	23.6	24.1	19.9
		Avg	28.3	29.5	24.8
Total War: Warhammer III	2560x1440 Ultra Preset	Min	81	80	97
		Avg	107	108	127
	3840x2160 Ultra Preset	Min	42	44	48
		Avg	57	61	66

CPU

AMD Ryzen 9 7950X3D

Cache, cores and cash.

■ \$1,139 | www.amd.com



In April 2022, to much fanfare, AMD released the Ryzen 7 5800X3D. It was the first desktop CPU to feature AMD's stacked V-Cache technology, boosting the amount of L3 cache from 32MB to 96MB. Cache sensitive apps received a substantial speed up, with many games receiving welcome performance boosts.

It was only going to be a matter of time before V-Cache came to Ryzen 7000 series CPUs. This time around, AMD is launching dual CCD (core complex die) 12-core 7900X3D and 16-core 7950X3D models. A single CCD 8-core Ryzen 7800X3D is scheduled to launch in the coming weeks. Theoretically, this means well

■ AMD Ryzen 9 7950X3D; Socket AM5; 16 cores/32 threads; 4.2GHz base/5.7GHz boost clock; 128MB L3 cache; Supports DDR4-5200; 120W TDP.

balanced CPUs combining high thread counts and high frequencies for productivity and creativity purposes with loads of L3 cache for gaming. A win-win.

AMD is launching the 7950X3D at \$1,139. That's a good price compared to Intel's Core i9 13900KS at \$1,199 but it's a lot more than the current street price of the 7950X, which at the time of writing was widely available for \$879. The 7950X3D really has to be a barnstormer of a CPU or drop in price if it's to win an unequivocal recommendation.

Up in performance

Vertical chip stacking is an evolving chip manufacturing method. As cutting-edge lithography becomes more expensive and challenging to implement, it's not feasible to make larger chips with more cache. So, if building in the x and y directions is difficult, why not the z direction? Skyscraper style. AMD built the Ryzen 7000 chiplets with through-silicon-vias (TSVs). These are vertical interconnects that pass through the chip itself, allowing AMD to take a modular approach to chip making.

	Handbrake 1.6	Cinebench R23	Cinebench R23	Blender 3.3 Whitlands	7Zip 22.01	Peak System Power Consumption	3DMark TimeSpy Extreme	
	Video conversion 4K to 1080p FPS	Rendering - Multi thread Score	Rendering - Single thread Score	Render Time (seconds) Lower is better	File Compression - Billion Instructions per second	Wall Draw (watts)	Overall score	CPU Score
Intel Core i9-13900KS	148.9	40,129	2,331	413	204.98	411	18,344	13,500
Intel Core i9-13900K	144.8	38,949	2,281	417	204.24	401	18,325	13,568
AMD Ryzen 9 7950X	135.9	38,127	2,043	405	226.55	347	18,038	12,793
AMD Ryzen 9 7950X3D	120.0	36,384	2,054	425	210.11	257	17,551	11,450

Rather than use resources to create multiple monolithic chips, it can use one or two CCDs and equip one with V-cache (or not) and use these chips across its entire range.

The Ryzen 9 7950X3D is fundamentally the same as the 7950X with extra cache and some power and clock speed adjustments. All the key features of the Zen 4 architecture are carried over. It's a chiplet-based design, with dual 8-core CCDs and a shared I/O die. It includes a dual CU RDNA 2 based integrated GPU and support for DDR5-5200. It's compatible with all current AM5 motherboards after a BIOS update. It also offers PCIe 5.0 support for both a GPU and SSD, though specific implementations are chipset and motherboard dependent.

From there the specs diverge. Where the 7950X includes 32MB per CCD for a total of 64MB, the 7950X3D comes with an extra 64MB for a total of 128MB. If one includes the L2 cache (1MB per core) the total is 144MB. Interestingly, only one CCD comes with stacked cache. AMD says this is for cost and diminishing return reasons, which makes sense. This leaves one die free to clock to higher levels and one die with gaming friendly V-Cache, though it requires software awareness to benefit fully. AMD could probably use some sort of hardware level thread scheduling, much like Intel's so-called Thread Director.

The 7950X3D is downclocked compared to the 7950X, but not by all that much. Its base clock is 4.2GHz, lower than the 4.5GHz of the 7950X, yet the boost clock remains the same at 5.7GHz. The lower all core clocks will certainly affect applications that respond favourably to clock speeds over cache. Is this compromise worth it? There is an upside. The lower all core clocks mean AMD was able to drop the TDP of the 7950X3D to just 120W vs the 170W of the 7950X. This means the

7950X3D is stunningly power efficient and much easier to cool than its Intel competition. That counts for a lot.

V-cache is still a little on the delicate side. AMD has taken a risk averse approach and disallowed overclocking, though you can still use PBO and Curve Optimizer features if you like.

Gaming is not always a win

With its price premium, the 7950X3D needs to deliver what it promises, which is gaming performance. The 7950X3D is faster than the 7950X and in some cases the 13900K and 13900KS, but it's very game dependent and a full picture would only emerge by testing dozens of games, which is impractical. Additionally, if you're using a mid-range GPU, any contemporary CPU will be sufficient. But when used with a flagship tier GPU, the 7950X3D is indeed very competitive with the 13900KS.

A 32 thread CPU needs to do more than just perform in games though. It needs to do well at productivity and creativity apps, and that's the weakness of the 7950X3D. Its lower all core turbo clocks see it fall behind the 7950X and 13th Gen competitors.

So, it's a bit faster in gaming and a bit more than a bit slower in apps. This leaves us wondering if the 7950X3D, in trying to be a one-for-all wonder CPU, isn't really a very logical CPU. If you primarily need the cores, the 7950X is the faster CPU, while being cheaper and losing relatively little in gaming performance. On the flipside, if you're a gamer, something like a 7700X, 13600K or the upcoming 7800X3D will be much cheaper, delivering very good performance allowing you to divert hundreds of dollars towards a GPU that

will deliver a more tangible gaming performance boost.

The Ryzen 9 7950X3D is a good CPU, but we get the feeling that the BIOS or software has a bit of catching up to do if this technological powerhouse is to reach its full potential. In the months ahead, with AGESA updates, AMD driver optimising, or game engine awareness, the 7950X3D could take another step forward, but for now it feels as though it's the wrong SKU to showcase Ryzen 7000X3D. The 7800X3D is definitely the one to watch out for. With a few exceptions, there's little need for a very high core count gaming CPU. Games need to run on laptops, quad cores and consoles before

they run on 32-thread \$1,000 monsters.

If you primarily load up your cores with demanding tasks and game a little, the 7950X3D could be the chip for you, but if you don't game, or on the flipside, you game a

lot, then there are better options, not least of which is AMD's own award winning 7950X. Let's hope the price of the 7950X3D falls a little in the months ahead, in which case it will add value for money to its stunning power efficiency and very good – if a little compromised all round performance.

Chip stacking is here to stay. If your workloads and chosen games can make use of all those cores and all that cache, we say go for it.

"The Ryzen 9 7950X3D is fundamentally the same as the 7950X with extra cache and some power and clock speed adjustments."

The 7950X3D is an efficient and powerful all-round CPU but its compromises mean it isn't a jack of all trades.

Chris Szewczyk

★★★★★

Ghost Recon: Breakpoint	Metro: Exodus Enhanced Edition		F1 2021	Tiny Tina's Wonderlands	Far Cry 6		Cyberpunk 2077	
	1080p, Low, Avg FPS	1080p, Ultra, DX12, Avg FPS	1080p, Ultra, DX12, Min FPS	1080p, ultra high Preset, Avg FPS	1080p, Ultra Preset, Avg FPS	1080p, Ultra high Preset, Avg FPS	1080p, Ultra high Preset, Min FPS	1080p, Ultra Preset, RT & DLSS off Avg FPS
313	156.5	98.1	471	314	193	149	216	97
311	153.8	95.9	465	309	190	147	216	96
313	152.0	88.2	435	297	177	138	188	74
305	156.8	100.1	504	308	193	142	209	89

CPU

Intel Core i9-13900KS

Six Gigahertz!

■ \$1,199 | www.intel.com

Back when Intel announced its 13th Generation Raptor Lake CPU family, it teased a special edition model, faster than the i9 13900K and one that could hit an amazing 6GHz out of the box. That CPU is the Core i9 13900KS. In short, if you're after the best 13th Gen CPU on the market, this is it, though it's not a CPU for everyone.

The 13900KS will set you back \$1,199 at the time of writing. That compares to the 13900K's launch price of \$1,099 which is reasonable, but since its launch, the K has fallen to around \$939, so you'll be asked to pay a hefty premium of around \$250 for the KS. That's also quite a bit more than AMD's formidable Ryzen 9 7950X at \$879 but not bad when compared to the 7950X3D at \$1,139.

Fundamentally, the 13900KS is an overclocked 13900K. That means it has 8 P-cores and 16 E-cores giving it a total of 32 threads. Both the P and E cores receive a 200MHz base clock boost over the 13900K, but it's the 6GHz maximum turbo clock that gets the attention. That's an increase of 200MHz over the 5.8GHz of the 13900K. The E core turbo clock is the same for both models. Both models support DDR5-5600 memory (unofficially it supports speeds well beyond this) and Intel's UHD 770 graphics.

Given the 13900K is already a power hungry processor, you'd expect the KS to consume even more power, and it does, but not as much as you might expect. The base TDP has increased from 125W to 150W, while maximum turbo power remains at 253W. Our total system power consumption testing showed the KS to use a peak of 411W under an all core load, just 10W more than the 401W of the K. Though we only have a sample size of one, the KS surely uses Intel's best dies, making it the better processor for hardcore overclockers.

"Against the 7950X and its X3D team mate it takes out its fair share of wins, though the AMD chips handily lead when it comes to power efficiency."

but low single digit percentage gains across productivity and gaming benchmarks aren't worth much in terms of tangible real-world results. Against the 7950X and its X3D team mate it takes out its fair share of wins, though the AMD chips handily lead when it comes to power efficiency.

Though its power and thermal

■ Benchmarks on the previous page.

■ Intel Core i9 13900KS; LGA 1700 socket; 8 P-Cores + 16 E-Cores, 32 threads; P-core Base/Max Clock Speed 3.2/6.0GHz, E-core Base/Max Clock speed 2.4/4.3GHz; 36MB L3 Cache; 150W Base Power, 253W Maximum Turbo Power.

The 13900KS was already a hot running CPU, and the KS is at least as demanding. Our 360mm AIO cooler was borderline inadequate. The KS easily hits 100 degrees leading to

some throttling. If you don't have premium cooling, forget the 13900KS.

When it comes to performance, the 13900KS is a beast, but then so is the 13900K. As you'll see on the benchmarks on the previous page the KS is the faster CPU

characteristics are hardly less demanding, the 13900K makes more sense. The likes of the 13700K and 13600K make even more sense for most users while the AMD competition remains strong both in terms of performance and value for money. Still if nothing else, It's great to see Intel and AMD battling for the performance crown.

The 13900KS is a CPU for those who demand the best performance with little consideration for power and thermal efficiency. Add to that its price premium and its appeal is generally limited to ultra-enthusiasts only. Still, it really is a very fast chip, in both performance and on paper. Six Gigahertz! Whoa!

The 13900KS is a very fast chip but its price premium over the regular 13900K makes it one for ultra enthusiasts only.

Chris Szewczyk

★★★★☆



ROUTER

Netgear Orbi RBK863S

A decent Wi-Fi 6 mesh, but the only thing that's really exceptional about this Orbi system is the price.

■ Price: \$2,099 | netgear.com



Netgear's Orbi meshes aren't cheap, but they typically offer excellent performance and a decent set of features. The latest model stretches the formula, though. It's an update to the Orbi RBK852, Netgear's first flagship Wi-Fi 6 mesh – but while it's still very much priced as a flagship product, it brings only modest enhancements to the original 2020 design.

Most notably, the Wi-Fi hardware hasn't been upgraded at all. At a time when most high-end meshes have moved to Wi-Fi 6E, the RBK863S uses the exact same Wi-Fi 6 configuration as the RBK852.

In fairness, it's a beefy tri-band system, with 2.4GHz and 5GHz connections for clients, plus an additional 5GHz network that the mesh stations use to communicate with one another. The 5GHz networks both support 4x4 MIMO, allowing for a maximum connection speed of 2.4Gbits/sec, and Netgear claims that the RBK863S introduces a new antenna design with 20 percent better coverage than the original model, so the three units can purportedly reach an area of 740 square metres.

There's one other upgrade to the hardware: the WAN connector has been boosted from 2.5Gbits/sec to 10GbE.

■ Tri-band 2.4GHz/5GHz/5GHz Wi-Fi 6 mesh; 4x4 MU-MIMO; 6 internal antennas (each station); 4 x Gigabit Ethernet ports (each station); 10GbE WAN port; 191 x 71 x 254mm (WDH); 1yr warranty.

However, even if you do have an ultra-fast broadband line, the Orbi RBK863S won't convey the full speeds it's capable of. That's because the LAN ports are stuck at single-gigabit speeds, while the wireless hardware tops out at 2.4Gbits/sec. It would have made much more sense to leave the WAN port alone and add multi-gig Ethernet on the LAN side.

The performance results weren't shabby. When my laptop was in the same room as the primary Orbi station, I recorded an average download speed of 84MB/sec. This dropped off only to 72MB/sec in the living room, with a minimum of 41MB/sec in the kitchen.

While that's fast enough to meet most people's needs, however, it's not special enough to justify the price. There's a simple reason for this. The ageing radio hardware in the Orbi RBK863S is limited to a maximum channel width of 80MHz, whereas modern meshes – including the RBK763S – almost invariably support the fatter 160MHz option. The RBK863S does have the benefit of 4x4 MIMO, but most devices you're likely to be connecting from are limited to 2x2 multiplexing, so

you'll only see a benefit from the RBK863S's 4x4 provision if you're connecting from two devices at once.

It's a shame, because Netgear's software features are, as usual, pretty good. Setting up the system: you just need to scan the QR code into the Orbi mobile app to connect, then choose a network name and security settings. You can then use either the app or a slick web portal to manage your network; the interface and features are exactly the same as with other Orbi meshes, including Netgear's incoming VPN server that lets you connect to your home network from anywhere.

Indeed, the whole deal feels like Netgear is trying it on. The Orbi RBK852 was a fine mesh in its day, but that was three years ago, and the technology has moved on. No matter what you're looking for, the idea of paying \$2,099 for the RBK863S is frankly laughable.

If you're focused on value, the RBK863 makes no sense.

Darien Graham-smith

★★★★★

GAMING MONITOR

MSI Optix G274QPF-QD

Is this new mid range offering the perfect value offering or a mid-range mess?

■ \$469 | msi.com



In a lot of ways the MSI G274QPF-QD gaming monitor looks like a pretty standard 27-inch mid-range gaming display offering 1440p resolution with a 170 Hz refresh rate, but a closer inspection reveals it's got some novel display tech to separate it from the pack. Most prominent of these is the Quantum Dot LED technology which you won't get on older screens and should dramatically increase brightness and colour capabilities.

The flat-panel WQHD monitor doesn't disappoint in this department, offering Versa Display HDR 400 certification and 93 or 95 percent colour space reproduction of the respective AdobeRGB and DCI-P3 colour gamuts. This will be great for professional work in the sRGB colour space and will even be suitable for most creative tasks in HDR colour, making it a competitive offering for a mid-range gaming screen.

1440p is a great resolution for a 27-inch monitor as it offers that extra crispness for work without costing the full whack of a 4K, but it's also a really

■ 27-inch Rapid IPS Quantum Dot display at 2560 by 1440 pixel resolution; 170Hz refresh rate; <1ms response rate; 400nit peak brightness; Vesa Display HDR 400; G-Sync Compatible; 93% AdobeRGB, 95% DCI-P3, 150% sRGB; 8bit + Frame Rate Control; 2 x HDMI 2.0b, 1 x DP 1.4a, 3.5mm audio; 61.3 x 40.2 x 19.7cm; 8kg.

decent resolution for gaming since you get an amazing looking image that will run at much higher frame rates than if you attempted to play in higher resolutions. You will still need a top end GPU from the last couple of years to play the latest titles at anything over 60fps in 1440p, so it's a really sensible resolution that provides the most bang-for-your-buck.

For those with an impressive gaming PC you'll be pleased to know that you can run full resolution at up to 165Hz in HDR colour, but if you do want to hit that full overclocked 170Hz spec you'll have to ditch the advanced colours. For those planning on hooking up a console you'll still be able to get 120Hz over HDMI 2.0b at when gaming in upscaled FHD or you can play 4K (downscaled to 1440p) at 60Hz. There's also a USB Type-C connection that offers display compatibility somewhere in between

DisplayPort and HDMI capabilities and is perfect for connecting laptops thanks to a 15W power passthrough.

The Rapid IPS Panel means you'll get response rates of under 1ms and Nvidia Variable Refresh Rate compatibility means you don't have to worry about screen tearing and other artefacts of high fps gaming. The menu interface is simple to use and offers all the colour and performance presets you could want, there's no shortage of interface and connectivity options and the screen isn't overly bulky or heavy so there isn't too much in the way of downsides here.

The only possible other feature you'd want in this price bracket is a curved display, but if you're keen on a flat panel (or connecting multiple panels together), then it's hard to imagine anything offering better value for money.

A perfectly balanced 1440P gaming monitor with great work potential at a reasonable price.

Joel Burgess

★★★★★

"1440p is a great resolution for a 27-inch monitor as it offers that extra crispness for work without costing the full whack of a 4K"

GAMING MONITOR

Acer Predator X32 FP

Acer's new large format gaming display has bright specs, but does it break enough new ground?

■ \$2,999 | online.acer.com.au



The Acer marketing pamphlet pitches the Predator X32 FP as a monitor targeted at 'professional gamers', but the E-sports space is still very much 1080p centric, so this 4K HDR monitor is more likely to appeal to creative professionals who also enjoy gaming than anyone who plays games for a living. The 165Hz refresh rate, which is more than enough for noobs (like me) and competent hobbyist gamers, but which is less than half the refresh rate of anyone actually attempting to compete competitively, is perhaps another indicator that Acer isn't actually going after the pros.

But while the company may have missed their target audience, it doesn't mean this display is any less desirable. The 32-inch 16 by 9 panel isn't large enough to look awkward on your desk, but it's close enough that you could theoretically use it as a 10 foot display if you want to hook up a console to it in a smaller living space. There's 4 HDMI 2.1 ports to choose from here so you can even leave multiple consoles, streaming boxes and your PC permanently connected, if you have a range of entertainment devices.

We saw a lot of larger format

■ 32-inch QLED display at 3840 by 2160 pixel resolution, 576-zone miniLED, 160Hz refresh rate, 1ms G to G response time, 99% AdobeRGB, 90% DCI-P3; DeltaE<1; VESA DisplayHDR 1000; 72.7 x 63.8 x 30.9cm; 10.3kg.

gaming screens arrive last year, but the Predator X32 FP has a couple of new technologies to give it the edge over older devices. The first is a 576-zone miniLED backlighting array that allows the screen to massively boost contrast in a picture by having greater control over the base level backlighting in different parts of the screen. This combines with the use of Quantum dot pixel technology to boost overall brightness offered and increase the levels of colour. These TV technologies allow the unit to achieve a VESA DisplayHDR 1000, which is a solid colour reproduction for a monitor.

This colour can be used professionally too thanks to a colour accuracy of Delta E of less than one and 99 percent AdobeRGB colour gamut coverage. This is ample for full professional image colour grading in HDR colour spaces. While these specs are generally used to certify professional capabilities it translates well into delivering seriously vibrant colour in games too, especially when you pair it with a 4K resolution and an

AMD graphics card that you can use AMD Freesync Premium Pro with.

You'll need the highest end discrete GPU of the last couple of years if you want to game at that resolution with 60-plus frames per second framerates, and don't expect to test the high end of the monitor's refresh rates unless you're playing older or less demanding titles at these resolutions.

For enthusiast gamers the only additional things you might think are lacking here are OLED technology, a curved screen and Nvidia HDR gaming compatibility, which really isn't a lot. That said, the device's \$3K price tag means it's one of the most expensive screens we've seen and against Samsung's range of Odyssey monitors it doesn't seem like the best bang for buck out there.

An impressive, bright and colour accurate 4K gaming display for enthusiasts that could do with a price cut.

Joel Burgess

★★★★☆

GAMING MONITOR

HyperX Armada 27

A gaming monitor without a stand? Is it revolutionary or misguided?

■ \$779 | <https://hyperx.com>



We've never seen a gaming monitor arrive without a traditional stand. Nonetheless, HyperX believes there's a market for such monitors and has dedicated its Armada range to supporting it.

The 27-inch panel arrived in a large box that, on opening, seemed to be full of scaffolding. At first glance the multiple, solid, metal bars and connectors seemed bewildering. Then we realised that parts were included that both allowed for the armature to be clamped to the rear edge of a desk and also to fit into special holes that adorn some desks towards the rear. You sometimes see the latter built into corporate, office desks where executive types don't want visiting clients looking at ugly desk clamps. If you want the extra neatness that this fitting affords, you can potentially drill a hole in your own desk, too.

Our battle station faces a wall, so we used the clamp. It's actually incredibly simple to fit together: you just clamp the base of the supporting 'pole' to the table, use a quick-release clip to attach the swing-arm to the back of the panel and slide the other end onto the pole. Too easy. You can even add additional swing-arms for additional monitors to the same pole.

■ 27-inch, matte, 2,560 x 1,440, flat-screen, 165Hz LCD with IPS panel. 400-nit brightness, 1000:1 contrast, G-Sync. DisplayPort 1.4, 2 x HDMI 2.0. Tilt -0o/+65o, Swivel 180o, Pivot 90o, 25.5cm height adjustment. 550 x 450 x 130 mm, 8.5kg.

We were concerned that the layer of glass atop our cheap IKEA desk might crack (or the particle board deform) which would mean the clamp would be too loose, but there weren't any issues. We were left with screen that was robustly suspended in space.

And what a difference! Suddenly, the usable space on our desk doubled!

The range of movement is dramatically improved over, even the most-malleable, fixed, monitor stands and it even pivots too.

There are some caveats though. There are just three connectors: DisplayPort 1.4 and two HDMI 2.0 ports. At least HyperX provides a long, red, DisplayPort cable and a long, black HDMI cable.

The 27-inch panel itself is very good for gaming. The 165Hz refresh rate marries with the 1ms pixel response time to ensure that even fast-moving objects are rendered smoothly and sharply, while G-Sync prevents image tearing. The 2,560 x 1,440 resolution displays a crisp Windows Desktop that's also great for work. The usual picture modes are included but we were happiest using

'Gaming' for everything. It can also display an on-screen crosshair.

Colours are reasonably vibrant and also accurate – it supports 95 per cent of the difficult DCI-P3 colour gamut – and transitions are smooth. But, monochromatic transitions are less impressive and contrast is only above-average. True blacks aren't visible and details can go missing in bright areas but, black levels can be adjusted to purposely degrade contrast further and reveal enemies hiding in shadows. Ultimately, you can find better colours and contrast elsewhere, but the Armada 27 ticks the important boxes.

While you can buy similar VESA arms separately for \$80, the overall price of \$779 for this package is reasonable. Ultimately, it's a decent gaming panel, on a great stand that suits multi-monitor set-ups and people craving more desk space.

An above-average gaming monitor that's elevated in desirability by its useful, desk-saving, swing-arm stand.

Nick Ross

★★★★☆

NAS

Synology DiskStation DS723+ NAS

Synology's latest two-bay NAS offers long-awaited features but more costly caveats.

■ \$799 | www.synology.com/en-au

Last year, Synology impressed us with its long-awaited, five-bay NAS (the DS1522+) and it impressed us despite a few caveats. Now here's its new, two-drive sibling, the DS723+ which is generally similar but also introduces a long-awaited new feature: solid-state storage pools... kind of.

The DS723+ takes many design cues from its older siblings. There are two SATA slots, two Gigabit Ethernet ports (which can be aggregated) and one stick of 2GB ECC RAM. The latter is a little low for memory-hungry functions like camera surveillance, but it can be upgraded to 32GB via an additional slot. Just note you need to use Synology's own brand of RAM and it's not cheap with 16GB modules costing around \$550 each – that's double the cost of third-party equivalents.

It's worth remembering that Synology is strict on which hard drives you use nowadays, too. Despite there being plenty of dedicated NAS drives being made by the likes of Seagate and WD, Synology only certifies a few, third-party, sub-16TB models. Using Synology's own drives comes at a premium with its 16GB unit costing \$1,100 – double what competitors charge.

Still, we were excited to see that the DS723+ (and its new, four-bay DS923+ sibling) finally support solid-state storage pools. These are facilitated by installing NVMe drives via the clip-in slots on the bottom. But, and this will surprise you, the feature only works if you use Synology's own components which are only available in 400GB and 800GB capacities that cost \$300 and \$520 respectively.

High-quality, third-party NVMe NAS drives typically cost under \$300 for 1TB.

As ever, the requirement for using bespoke, expensive components is justified by claims from Synology that everything else degrades stability, but it's a claim that's wearing thin. While there's an

"It's worth remembering that Synology is strict on which hard drives you use nowadays, too."

element of truth that high-capacity NVMe hard drives can generate additional, problematic heat, the fact that so few dedicated NAS drives from high-quality third parties are still not certified is beginning to whiff a bit – especially considering that Synology itself uses re-badged, third-party Toshiba drives.

Still, one optional component that's proving more welcome is the special PCI port at the rear which supports a \$300, 10-Gigabit network adapter. While it's not cheap, having 10GbE networking and dual-NVMe drives, does enable real-world, read and write speeds of around 1,000MB/s and 800MB/s respectively. That's one heck of a jump from SATA's typical sub-200MB/s read and write speeds.

Other features include a rear-mounted eSATA port and a front-mounted USB-A 3.2 Gen 1 port for

connecting external storage.

A dual-core, four-thread, 3.1GHz AMD Ryzen CPU keeps everything running smoothly although video transcoders may want more. Different components will create different thermal profiles, but our dual-SATA-populated unit only emitted a mild whooshing sound under load.

Synology's software is excellent, as always. Its legendary DSM operating system and platform remains robust and intuitive and offers an unsurpassed, comprehensive library of free, well-supported (and well-documented) home-and-enterprise NAS and server applications.

At \$799 it's not cheap (especially with upgrades) but, as ever, the outstanding software boosts the value proposition.

It can get frustratingly expensive, but Synology's software makes this the best two-bay NAS around.

Nick Ross

★★★★★



■ 3.1GHz dual-core Ryzen R1600 CPU, 2GB DDR4 ECC RAM (expandable to 32GB). 2 x lockable 3.5-inch drive bays, 2 x NVMe M.2 drive bays, 1 x eSATA, 1 x USB-A 3.2 Gen 1, 2 x 1Gb Ethernet ports, 1 x PCIe x8 slot, Synology DiskStation Manager operating system.

ROUTER

Asus ROG Rapture GT-AXE16000

It seems Asus hasn't been happy with its recent stream of overkill gaming routers. So, it's made an even better one...

■ \$1,299 | rog.asus.com/au

Asus is in a mad race with itself to produce the fastest, most overpowered, feature-laden wireless router. It must already hold at least nine of the Top 10 positions for super-premium gaming routers, yet the new ROG Rapture GT-AXE16000 is this week's standard bearer.

It's big, brash, spikey and the wife hated it. The RGB top (and its seven pre-set patterns) illuminates half the house at night and there's no timer to turn it off. Set-up is simple: just scan a QR code on it's bottom with Asus' phone app, set the network name and password and voila.

The phone and browser apps are well designed. They're responsive, show connection statuses, alert you to issues (and suggest solutions), provide extensive QoS options, include server-grade apps, enable mesh network creation (from other Asus routers) and offer a plethora of premium, consumer router features. There are extensive, easy-to-set-up, parental controls which bind children and devices together and set either online or offline schedules for weekdays and weekends. There's also (adjustable) content blocking with pre-sets for different age groups and, unlike some rivals, you don't need to pay a premium for the feature. Neither must you pay for the built-in security which comes via Asus' Trend-Micro-powered AiProtection feature.

In addition to four Gigabit Ethernet (two can be aggregated), USB 2.0 and USB 3.0 ports there's a 2.5GbE WAN port (which can be aggregated with one 1GbE LAN port) and two (count'em) 10GbE ports, one of which can also be used for WAN. Inside there's a 2GHz, quad-core CPU that keeps everything ticking under load.

The GT-AXE16000 also supports



■ Speed: Wi-Fi6E 16,000Mbps | Connectivity: 4 x Gigabit Ethernet, 1 x 2.5Gbps WAN, 2 x 10Gbps W/LAN, USB-A 3.0, USB-A 2.0 | Features: 2GHz Quad-Core CPU, Trend Micro Security and family controls, extensive QoS optimisation, Alexa and Google Assistant compatible.

quad-band Wi-Fi with a crazy 16,000Mbps theoretical throughput. That's spread across a 2.4GHz band, two 5GHz bands and the new 6GHz band. Despite the power and the simple design, we had issues testing it. Neither our new Wi-Fi6E sporting Dell XPS 15 nor our new Asus Zenbook recognised the 6GHz band, whether it was bound together with other bands or separated. Only our Asus Zenfone did! That's despite driver updates and location hacks (not every global region allows the same 6GHz channels to be used).

Still, it flew in our tests. Up close we downloaded large movie files from our NAS at 825Mbps. Two rooms away, in our

weatherboard cottage, it only dropped to 520Mbps, which rivals the best two-node, mesh systems. At the bottom of the garden (25m away) it managed 101.5Mbps. While the latter is a little slow compared to rivals, it's worth remembering that, once the new Wi-Fi6E connections settle down, this router has a great deal more headroom to go faster.

Other special gaming features include shortest-route-to-game-server optimisation, game packet priority (even when a VPN is running) and a Mobile Game Mode that ensures phone-based games get top priority.

Ultimately, it's the highest-spec consumer router available, but is extreme overkill for most users. At \$1,299, most people should look at Synology's speedy, feature-dripping, rivals which cost much less. But, we have to admit, those don't carry the aspirational cachet of this monster from Asus.

The most splendid, overpowered router on the market. But, it's silly money and aspirational to most users.

Nick Ross

★★★★★



KEYBOARD

Ducky One 3 Aura Keyboard

The Mercedes car door of typing keyboards.

■ \$229 (TKL Black), \$189 (Mini White) | pccasegear.com

The quest to find a keyboard that's a joy to do the business of actually typing on can be confusing. With so many keyboards claiming gaming chops, and seemingly being the only options for something that's nice and premium, what about people that just want a slick daily driver that feels great to use?

Enter the Ducky. This Taiwanese brand has been designing keyboards that are always just a little bit different for many years, and the company has a stellar reputation amongst keyboard enthusiasts. It's a diversified range, with some of the more exotic Ducky boards offering much of the style and uniqueness of a custom board with custom keycaps – but without the DIY fiddling. Indeed, even the more middle of the road boards like the new Ducky One 3 Aura we're looking at today feature easily hot-swappable keycaps, and there are a great many attractive options available to customise your standard board, or just pick one of the cool colour combos Ducky has off the shelf.

By far the biggest selling point for the Ducky One 3 Aura in regular use is the feel. It's just sublime. I've been testing two models from the One 3 Aura range that use Cherry RGB Silent Red keys, and my gosh are they nice. The movement is smooth and luxurious, yet with a firm sprung feeling when pressed that suits long periods of typing so well. Mistakes are rarer, and the experience is delightfully premium.

But many companies use Cherry switches. What makes the Ducky feel so good? It comes down to an extremely rigid and solid base,

combined with a padded acoustic dampening layer that sits under the length of the board, as well as a supplementary layer of EVA foam underneath the PCB. It's all quite Mercedes car door as a result. Even the space bar test – which most keyboards fail with an uneven clatter – is bang on here with a smooth movement that's quiet and consistent across the length. It screams quality, in complete silence.

The standard range of Cherry switches is available for almost any model in Ducky's rather huge range.

The lighting scheme is also a little bit different. Instead of shining through clear lettering on the top of the cap, the light spills out via clear

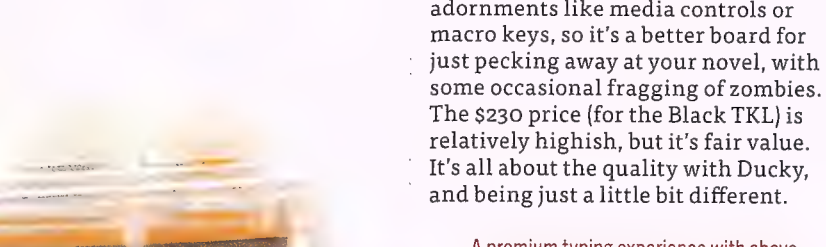
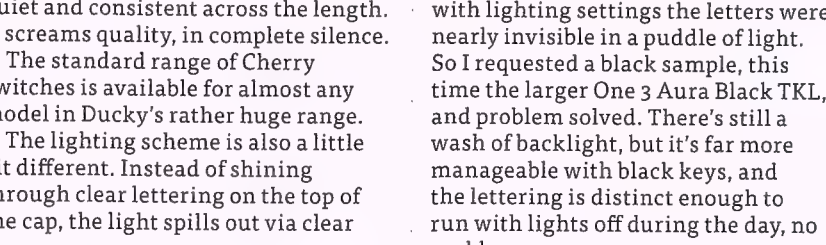
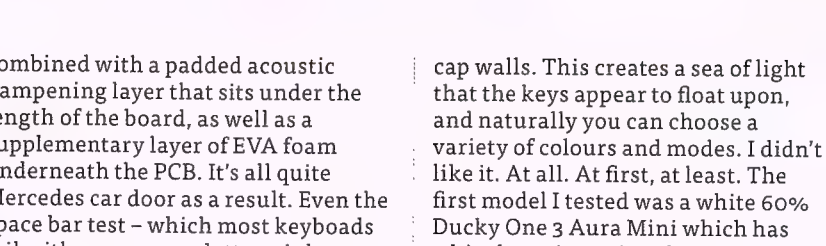
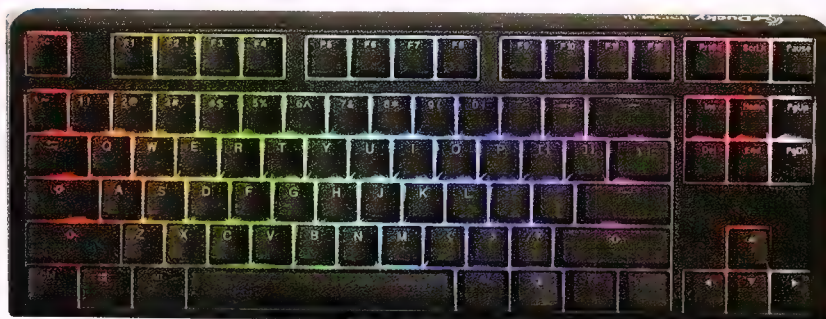
cap walls. This creates a sea of light that the keys appear to float upon, and naturally you can choose a variety of colours and modes. I didn't like it. At all. At first, at least. The first model I tested was a white 60% Ducky One 3 Aura Mini which has white lettering printed on white keycaps, and no matter how I messed with lighting settings the letters were nearly invisible in a puddle of light. So I requested a black sample, this time the larger One 3 Aura Black TKL, and problem solved. There's still a wash of backlight, but it's far more manageable with black keys, and the lettering is distinct enough to run with lights off during the day, no problem.

It games well too, but is free from adornments like media controls or macro keys, so it's a better board for just pecking away at your novel, with some occasional fragging of zombies. The \$230 price (for the Black TKL) is relatively highish, but it's fair value. It's all about the quality with Ducky, and being just a little bit different.

A premium typing experience with above average build quality that's just nice to use.

Ben Mansill

★★★★★



Windows 7, 8.1, 10 or 11, macOS or Linux | freetubeapp.io

FREETUBE 0.18

Screen-Capture tool.

Watch videos on YouTube and you'll be watched yourself. This is because Google tracks your viewing habits and targets you with adverts. FreeTube solves both these problems by providing an alternative front-end for YouTube that lets you stream videos privately on your desktop without having to sit through endless ads.

This open-source program has a simple, streamlined design that lets you quickly find videos on YouTube or browse its 'trending' and most popular content. When you first run FreeTube, you'll see an empty Subscriptions page, but you can ignore this and start searching for something to watch. Your search results can be filtered by upload date, duration, view count and other criteria, and you can save videos to a playlist to watch them later and

subscribe to channels without signing into an account.

FreeTube lets you watch YouTube videos within its own window, view them full screen or pop them out into a floating window by switching to Picture-in-picture mode. Best of all, you can download videos to your computer in MP4 format by clicking the Download Video button below the media player and choosing your preferred resolution.

The latest version of FreeTube, which is officially still in beta, displays a progress bar when you're watching a playlist so you can see how

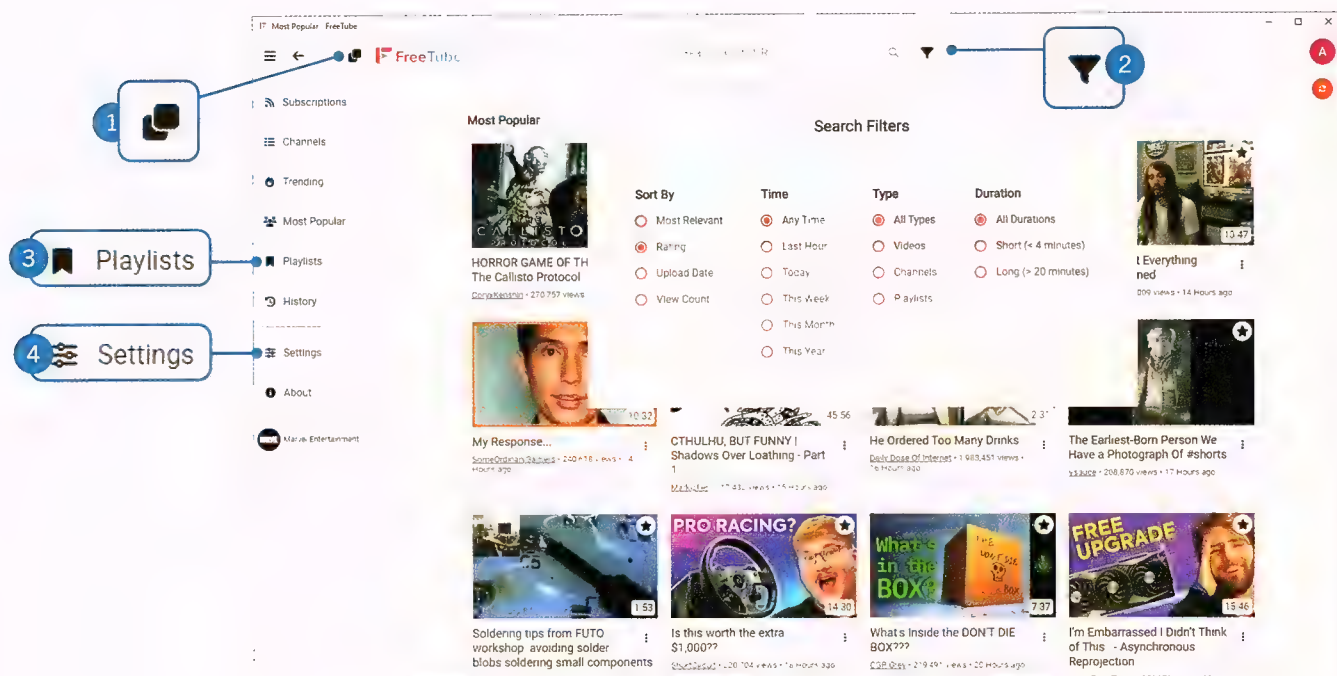
much time has elapsed and how much is remaining. It also splits long videos into chapters, as on the YouTube website, and lets you refresh the Subscriptions,

Trending and Most Popular pages by pressing R on your keyboard. Additionally, if you have a touchscreen laptop, you can skip back and forth through videos by tapping the left or right-hand side of the player.

Click 'More info' then 'Run anyway' if you see

a SmartScreen warning when installing – it's safe to use, with a clean bill of health from VirusTotal (see www.snipca.com/44340).

"This program has a simple design that lets you quickly find videos on YouTube or browse 'trending' and most popular content."



1 You can open a new FreeTube window by clicking the overlapping squares icon to the left of its logo. This lets you watch videos while continuing to search the site. Alternatively, switch to its Picture-in-picture player.

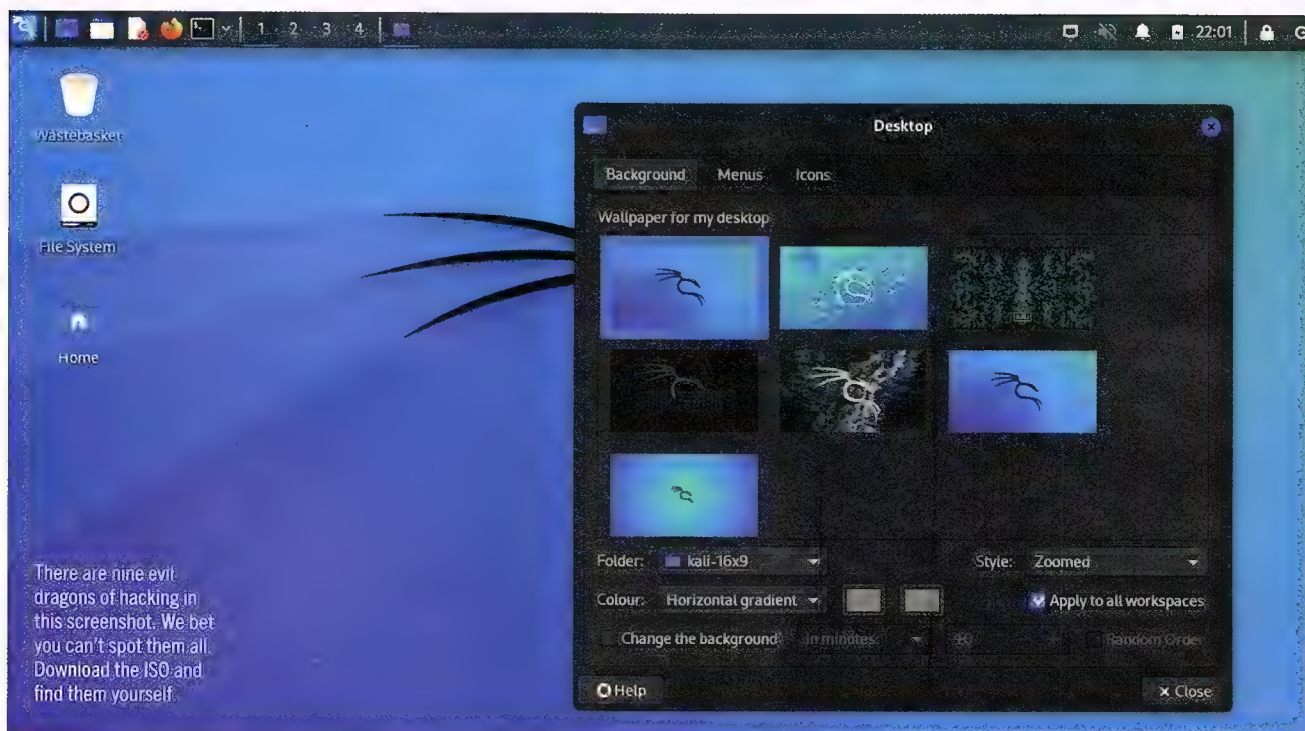
2 Click the funnel button next to the search box to filter your search results using several criteria. These include how recently the video was uploaded, its duration and the number of people who have viewed the clip.

3 Click the star icon in the top-right corner of a video to save the clip to watch later. It will then appear in the Playlists section of the program. YouTube channels you subscribe to are added to both Subscriptions and Channels.

4 Select 'Settings' to configure how FreeTube looks and works. You can change the colour of its theme (including to dark mode); hide recommendations and user comments; and block sponsored messages in videos.

KALI LINUX 2022.4

If you exist in the grey twilight between good and evil, and want to look cool while doing it, David Rutland has just the distro for you.



Kali Linux is an evil distro for hackers, ne'er-do-wells and other undesirables who want to overthrow the state and sow chaos. You can tell because of the menacing wallpapers that feature evil-looking dragons, who are doubtless up to no good.

There's also the vast array of tools designed for network analysis, penetration, password cracking and other such things, which we'll get to shortly. They're kind of a giveaway.

Rapidly approaching its tenth birthday, Kali is the go-to distro for individuals in the network security field, those wanting to get into the field, and people who want to look cool and mysterious while hammering on a keyboard in the local cafe.

The 22.04 release just squeezed in before the end of 2022, and in recognition of the essential nature of the ubiquitous Raspberry Pi, Kali has now been added to the Raspberry Pi Imager tool, so it's simple to install this hacker's toolkit on proper DIY hacker hardware.

Unfortunately, Pis are in short supply, so we had to make do with installing Kali the old-fashioned and proper way: on a virtual machine. You can also install Kali on WSL, as a live USB, in a docker container, as a vagrant image, as a ready-to-go app on various cloud providers, or even on

certain mobile phones. Hardware resource access, and other more esoteric factors, may vary, but Kali makes it easy to install on anything – with dedicated images for each, so you can maximise the resources of what's available.

Kali is based on Debian, so installation on our decidedly non-exotic VM was simple and familiar, once the epic download of up to 11GB was out of the way. There were no nasty surprises or unnecessary complications, and after selecting Xfce over either Gnome or KDE, we were on the desktop in a couple of minutes, staring into the side-eye of a malevolent dragon who wanted us to hack something – anything!

Because, don't get us wrong, unauthorised entry is Kali's *raison d'être*. Sure, you can use it as a daily driver, and it's great. You get everything you'd expect with a minimum Debian install – plus a whole lot more. You can install LibreOffice, GIMP and Steam without too much trouble. But that's not what Kali is about.

The central tool suite of Kali has been more or less the same since its inception, but there are refinements in this latest release. Particularly notable are updates to the wireless firmware, and better wardriving

Bluetooth, SDR and MouseJack support – just what you need when penetration testing.

There are some additions, too. These include bloodhound.py, a Python-based ingestor for Bloodhound (a tool for finding hidden relationships within an active directory or Azure environment); peass-ng, a collection of privilege escalation tools for Windows, Linux and Mac OS; and ldapdomaindump, which does exactly what you probably think it does.

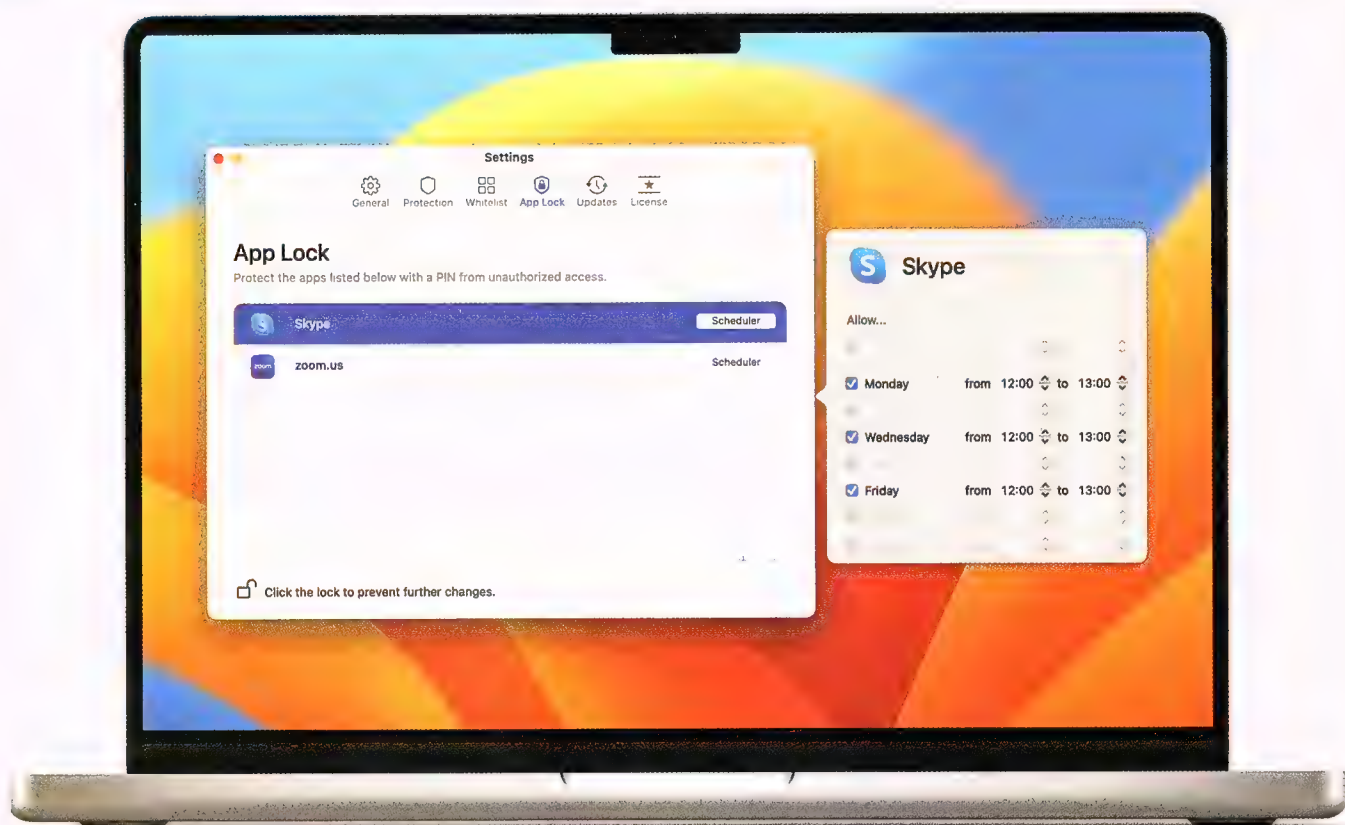
Everyone knows that 1337 haXors are all about the cool eye-candy, and Kali doesn't disappoint. Desktop-wise, Gnome lovers will be pleased to find Gnome 43 as an option. You can also deploy your exploits from KDE Plasma 5.26. As always, the wallpapers are top-notch artwork, usually featuring dragons. There's also a graphical network monitor in the task bar – neat.

All you need is a trenchcoat and some RGB, and you can be the hero of your own cyber action movie.

Even without its killer suite of ethical hacking tools, Kali is the ice-cold epitome of style and substance, which is as easy to use as you'd expect from a Debian derivative.

Nate Drake

★★★★★



macOS 10.15 or later | US\$19.90/year | protectstar.com

CAMERA GUARD FOR MAC

Lock down your Mac with ease.

You can choose to restrict access for any app to certain days and times.

There is a slightly uncomfortable truth that nobody can be absolutely sure that their webcam and microphone haven't been compromised. While suggestions that government agencies may be spying on you veer somewhat towards the outlandish, it's certainly the

case that malware exists and can be a problem.

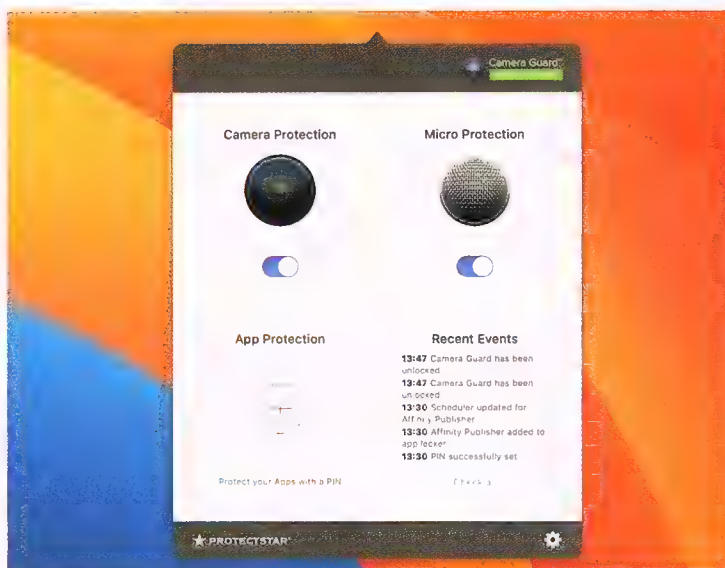
The Mac platform is secure but it's not perfect, and just because the little green light by the camera is not active doesn't mean you are 100 percent safe. In our constantly connected world, cyber theft and spying are issues that we

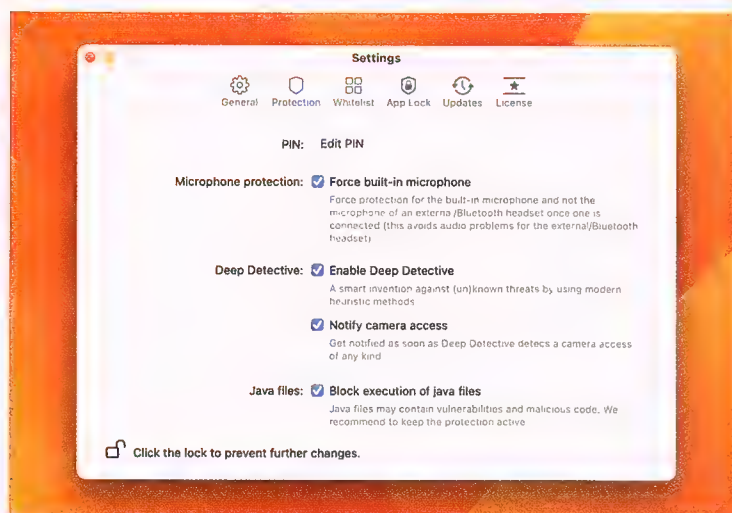
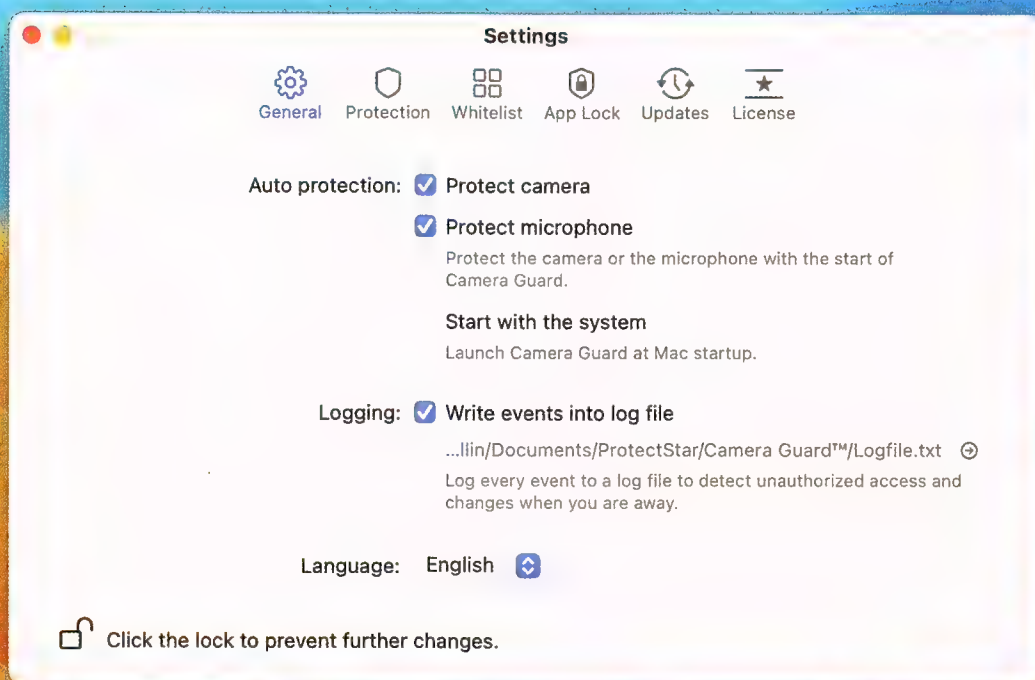
do need to be aware of.

If you have concerns about this, Protectstar makes Camera Guard, an app for Mac that can block your microphone and webcam and also provide access control for other apps installed on your system. Apple doesn't provide any way to completely disable either kind of device, short of taping them up which is suboptimal. The interface is pretty straightforward, with camera and mic protection simply on or off, and the option to receive a notification if any access attempts are made on your camera.

You can set a whitelist of apps that can access the camera so you can ensure no hassles with FaceTime or Zoom for example, while still guarding for other unauthorised usage. You can also switch on Deep Detective which apparently keeps watch in a more aggressive way, though the company doesn't explain this in detail, probably for reasons of security. This includes low-level constant scanning to guard against

The app is able to constantly monitor your Mac for ransomware and other threats.





"Surprisingly unobtrusive for an app that's monitoring your Mac's hardware"

ransomware and other nasties. A further option lets you block the execution of Java files, which can be a source of malware.

Restricted access

A slightly less alarmist feature, and one that will be useful for parents, is the ability to set a PIN-controlled access list for apps. This is really

straightforward to use and will prevent a user being able to open messaging apps or games for example, if you are looking to restrict their access. A granular option lets you set a schedule per app, meaning you can control what times an app is able to be used. No messaging apps after bedtime would be a typical example of this sort of thing.

Camera Guard is surprisingly unobtrusive for an app that's constantly monitoring your Mac's hardware, and doesn't appear to place any significant load on the system unlike antivirus apps of old. The camera and mic protection are good to have if this is something you worry about, but the more general threat scanning and the ability to limit app use by schedule are also things that will be useful.

In testing, we didn't receive any notifications about threats, which is of course good since that presumably means our system is clean, but it's nice to have the peace of mind that your Mac is protected, and indeed that nobody is maliciously trying to access your microphone or camera. It's sensibly priced too and doesn't use a subscription model, though the price only gives you one year of updates.

All access attempts are logged, and the app can boot with the system.

A slick way to lock down your Mac's hardware.
Hollin Jones

★★★★☆



AUSTRALIAN PC AWARDS

2023

Finding gold in what was a very rocky mountain of a year. Words by Ben Mansill, Joel Burgess and Chris Szewczyk.

Welcome to a particularly interesting edition of the Australian PC Awards. Unlike most years in tech which are clean, tidy periods where everything runs smoothly and we all buy loads of nice new things, 2022 turned that upside down with one drama after another, all in a market where actual products you could buy were scarce, expensive, or delayed.

This is not to say the actual products were duds – au contraire – the tail end of 2022 in particular saw a spectacular period of new GPUs and CPUs, along with exciting new motherboard platforms. DDR5 got its act together and became good, and affordable, laptops leapt into new realms of low power and high performance, and some standout new techs blew us away, like QD OLED monitors.

The editorial teams here at APC, *Tech Radar*, *PC Gamer* and *PC PowerPlay* thoroughly enjoyed compiling these finalists, and then selecting the winners. It was a fascinating year with highs and lows. The highs weren't in short supply, it's just that the lows exceeded the expected quota by an alarming amount.

But, we have selected our winners and they are clear to us as the best of the best. Read on and see what got the big gongs, as well as what gear made our finalist lists. Maybe you agree, maybe you have differing opinions. That's all good, 2022 was a confusing year, but thanks to these 2023 Australian PC Awards the cream has been separated and all the good stuff properly rewarded.

Motherboards

We were really spoiled for choice when it came to motherboards in 2022. Both AMD and Intel released new platforms meaning we had a huge variety of boards to choose from.

In September, AMD released its AM5 platform, which added support for DDR5 memory. High end X670E boards were joined by X670, B650E and B650 boards. Four chipsets? Actually, they all use the same chip. It's just that the X series uses two of them, while the B series uses one. AMD says it intends to support AM5 for several years to come. If it has a long life like AM4 did, then you can expect to be able to upgrade to a Zen 5 or Zen 6 processor with just a BIOS flash.

Just a month later, Intel released its 13th Generation CPU range accompanied by Z790 motherboards. Z790 is more or less an evolution over Z690 with a better I/O thanks to the inclusion of more PCIe 4.0 lanes.

This means Z790 boards typically have improved support for high bandwidth devices and controllers, including things like more PCIe 4.0 M.2 slots or things like USB 4 or Thunderbolt 4 controllers.

Sadly, high quality motherboards are now expensive. It wasn't long ago that a \$500 motherboard was regarded as ultra-premium. Now, \$500 is considered mid-range.

But if you are prepared to pay, at least you can expect a high-quality product. Things like the power delivery, cooling, USB port count and speeds and support for faster M.2 drives mean you'll have a motherboard that will happily power a system for many years to come, no matter what you use a PC for.



BEST MOTHERBOARD MAKER

GIGABYTE AORUS

Gigabyte's Aorus boards usually impress us with their quality feature sets, good value for money and cooling potential.

HIGHLY COMMENDED: Asus, MSI

FINALISTS: Asus, Asrock, MSI, Gigabyte Aorus

BEST PREMIUM MOTHERBOARD

GIGABYTE X670 AORUS ELITE AX

The X670 Aorus Elite AX stands out with its excellent design and feature set. It offers everything you should realistically need without the exorbitant price of the flagship tier boards.

HIGHLY COMMENDED:

Asus ROG Crosshair X670E Hero

Asus ROG Strix Z790-I Gaming Wi-Fi

FINALISTS: MSI MEG X670E Ace, Asus ROG Crosshair X670E Hero, Gigabyte X670 Aorus Elite AX, Asrock X670E Taichi, MSI MAG Z790 Tomahawk DDR4, Asrock Z790 Steel Legend, Gigabyte Z790 Aorus Master, Asus ROG Strix Z790-I Gaming Wi-Fi

BEST VALUE MOTHERBOARD

MSI MAG B660M MORTAR MAX WIFI DDR4

This is a very good motherboard in general, but its ability to overclock a locked 12th Gen processor reminds us of the days of overclocking budget CPUs to high end performance levels. That's real value.

HIGHLY COMMENDED:

Asus Prime B660M-A Wi-Fi DDR4

Gigabyte B650M Aorus Elite AX

FINALISTS: MSI MAG B660 Tomahawk Wi-Fi DDR4, Asus TUF Gaming B660 Plus Wi-Fi D4, Asrock B660 Pro RS, Gigabyte B660I Aorus Pro DDR4, Asrock B650E PG Riptide Wi-Fi DDR5, Gigabyte B650M Aorus Elite AX, MSI MAG B660M Mortar Max Wi-Fi DDR4, Asus Prime B660M-A Wi-Fi DDR4

Graphics

When it comes to graphics cards, 2022 was very much a tale of two halves.

The first part of the year was dominated by the influence of crypto mining, covid fallout and ongoing geopolitical concerns. That meant GPU pricing was simply ridiculous.

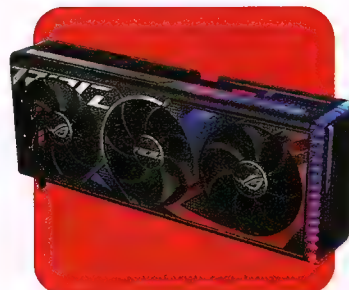
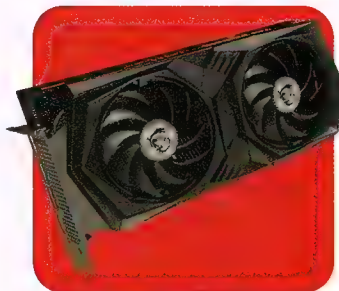
Once Ethereum shifted away from GPU mining, things slowly returned to normal. Stocks consistently appeared on shelves, prices dropped and PC gaming came back from its perilous position.

With mining in the rear view mirror, the latter part of 2022 was genuinely exciting thanks to the release of Nvidia's RTX 40 series and later on, AMD's RX 7900 series. Intel's long gestating Arc cards also made their debut, though they didn't have the impact Intel would have hoped for.

The RTX 4090 was unveiled in September. It retained peak mining era pricing, but if you were prepared to pay, you were rewarded with the highest performing GPU ever made. The RTX 4080 followed, and though it's an excellent GPU, its popularity suffered as a result of its high price.

The end of the year saw the release of AMD's RX 7900 series. While the 7900 XTX couldn't knock the 4090 off of its perch, RX 7900s are still competitive options with both introducing chiplet technology to consumer GPUs for the first time.

If 2022 was the year of high prices and high end cards, 2023 is looking better, with both companies (and perhaps Intel too) set to release compelling mainstream options.



BEST GRAPHICS CARD MAKER

MSI

MSI consistently produces high quality graphics cards that offer an excellent blend of build quality, cooling ability, and low noise levels without charging the Earth.

HIGHLY COMMENDED: Asus, Sapphire

FINALISTS: Asus, MSI, Gigabyte Aorus, Asrock, Sapphire, Zotac, Powercolour

BEST VALUE GRAPHICS CARD

MSI GEFORCE RTX 3050 GAMING X

The MSI GeForce RTX 3050 Gaming X stood out in a very tough market thanks to its excellent cooling and shockingly good value for money.

HIGHLY COMMENDED:

XFX Speedster MERC 308 RX 6650 XT

Gigabyte GeForce RTX 3050 Gaming OC 8GB

FINALISTS: MSI GeForce RTX 3050 Gaming X, Sapphire Pulse Radeon RX 6400, MSI Radeon RX 6650 XT Gaming X 8G, Gigabyte GeForce RTX 3050 Gaming OC 8GB, XFX Speedster MERC 308 RX 6650 XT, Gigabyte Radeon RX 6500 XT Eagle

BEST PREMIUM GRAPHICS CARD

ASUS ROG STRIX RTX 4090 OC EDITION

If you want the best, and don't mind paying, then there's only one choice: The RTX 4090. Asus took a great GPU and made it better.

HIGHLY COMMENDED:

Sapphire Nitro+ Radeon RX 7900 XTX Vapor-X 24GB

FINALISTS: Asus TUF Gaming GeForce RTX 3090Ti, Asus ROG Strix RTX 4090 OC Edition, MSI GeForce RTX 4080 16GB Suprim X, Asus TUF Gaming GeForce RTX 4080 OC Edition, Sapphire Nitro+ Radeon RX 7900 XTX Vapor-X 24GB



BEST VALUE CPU

CORE i5 12400

The Core i5 12400 really punches above its weight, delivering excellent performance at a genuinely budget price.

HIGHLY COMMENDED

AMD Ryzen 7 5700X

FINALISTS

Intel Core i5 12400F, AMD Ryzen 7 5700X, AMD Ryzen 5 5600, Intel Core i3 12100



BEST MID-RANGE CPU

INTEL CORE i5 13600K

The i5 13600K is a stellar CPU. It's an excellent choice for gaming, productivity or general use, without needing too much power or requiring expensive cooling.

HIGHLY COMMENDED

AMD Ryzen 7 5800X3D

FINALISTS

Intel Core i5 13600K, Intel Core i7 12700, AMD Ryzen 7 5800X3D



BEST PREMIUM CPU

AMD RYZEN 9 7950X

The 7950X narrowly takes out the win thanks to its excellent all round performance, and doing so without letting go of power efficiency.

HIGHLY COMMENDED

Intel Core i9 13900K

FINALISTS

Intel Core i9 13900K, AMD Ryzen 9 7950X, AMD Ryzen 7 7700X, AMD Ryzen 9 7900X

CPU

2022 was a huge year for CPU releases.

The start of the year was dominated by the release of Intel's mainstream 12th Generation range including the excellent Core i5 12400. AMD also fleshed out its Zen 3 range, with more affordable Ryzen 5000 series CPUs. All of these CPUs were welcome at a time when value for money was becoming a difficult thing to find.

One of the highlights of the year, if not the last decade, was the release of the AMD Ryzen 7 5800X3D. Its stacked cache is very much cutting-edge technology. This CPU with its 96MB of L3 cache offered gamers in particular a very compelling upgrade option. Chip stacking is a big part of AMD and Intel's future plans.

These were impressive and highly recommended CPUs, but the big headlines were reserved for the September launch of AMD's Ryzen 7000 series CPUs, and just a month later, Intel's 13th Generation CPUs.

Both can be considered an evolution over their predecessors, delivering generally better performance and/or power efficiency. Intel increased core counts across the range, negating the advantage AMD held for many years.

It wasn't all cheers and high fives though. Both companies generally increased their power consumption levels at each product tier which means there's a need for very good cooling to tame the faster chips from both AMD and Intel.

"The start of the year was dominated by the release of Intel's mainstream 12th Generation range including the excellent Core i5 12400."

Storage

If 2022 was a big year for PC component releases, the storage industry wasn't so exciting.

That's not to say PC storage isn't faster and more affordable at each capacity, it's just that there wasn't a product or release that didn't feel like an evolution of something that came before. The best drives in 2022 weren't necessarily the fastest ones, but rather the ones that offered a good balance of speed, capacity and value for money.

PCIe 4.0 drives saturated the market and more or less hit their performance ceiling, at least in terms of sequential transfer speeds. With lots of competing brands, a high speed M.2 drive became more affordable than ever – a win for consumers.

PCIe 3.0 M.2 drives became relegated to budget status. As they approached price parity with SATA drives, they became very good options for things like bulk media storage or for storing space hogging game libraries.

Speaking of SATA, the humble hard drive isn't going away any time soon. Large mechanical drives are still much cheaper per gigabyte than flash solutions and they remain highly relevant.

We expected PCIe 5.0 SSDs to launch in 2022, but sadly they were nowhere to be found.



BEST INTERNAL STORAGE MAKER

WD

Western Digital introduced some excellent SSDs that offered great value for money – something we can all appreciate – while losing little performance to much more expensive drives.

HIGHLY COMMENDED

Samsung

FINALISTS

WD, Samsung, Silicon Power, MSI, Kingston, PNY, Seagate, XPG



BEST EXTERNAL STORAGE MAKER

SAMSUNG

The field was flooded by fast external and portable storage devices, but Team Samsung shone the brightest, as exemplified by the T7 Shield, which packs USB-C 3.2 Gen 2 NVMe performance into a very rugged enclosure with great security features.

HIGHLY COMMENDED

Team Group

FINALISTS

Team Group, WD, Seagate, Samsung,ADATA, SanDisk, PNY, LaCie

Systems

2022 was the year of systems defying size expectations and breaking norms.

Whether it was Apple releasing a MacBook Air that's more expensive than a number of MacBook Pro devices, or Razer's Blade 15 with a 3080 Ti that's thinner and lighter than a LG Gram 16 2-in-1 and MacBook Pro 16, today's engineering is shrinking powerful components into unbelievably compact packages.

The fourth generation of NVMe PCIe SSDs ushered in practical read speeds over 7,000MB/s and write speeds of more than 5,000MB/s. Rates that almost seem more like RAM transfer speeds than something that you'd use to retrieve Word and OS files.

We saw a handful of OLED screens on approachably priced ultrabooks and many of the players at the top end are introducing novel features like integrated glass trackpads, displays on the outside of laptops, laptop screens that hinge like drawing tables, and others that have a whole second screen emerging from the keyboard.

We reviewed laptops you have to assemble yourself from the ground up, and others that you have to tear down to the most granular level to work out how they function.

Professional gamers can now expect their portable rig to offer 360Hz displays, while recreational gamers can indulge in HDR games at high refresh rates on 1440P or even 4K screens if they don't mind paying for it.

GPUs were a bit of a minefield again this year, with TDP Wattage and thermal dissipation capabilities impacting performance significantly more than the label on the tin. Even then wattage didn't translate perfectly into performance either, so it's more critical than ever to read a review of the laptop you want to buy to understand its performance.

Intel's 12th gen laptop processors shifted to a high core count dual-performance-and-efficiency core array structure that dramatically improved performance across the board, Apple tweaked its original processor with new memory bandwidth and AI capabilities in the M2 and Nvidia introduced Optimus to greatly improve the experience of trying to optimise battery life and performance on gaming laptops.



BEST VALUE LAPTOP OR 2-IN-1

MICROSOFT SURFACE LAPTOP GO 2

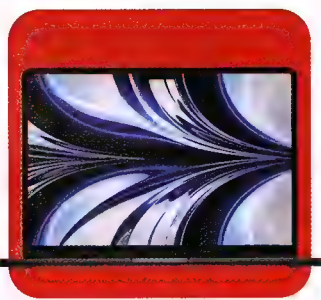
Offering enough power to smoothly run Windows 11 in a sleek touchscreen laptop with current networking and connectivity specs for \$1k is a pretty great deal.

HIGHLY COMMENDED

Lenovo IdeaPad Duet Chromebook Framework Laptop

FINALISTS

Acer Enduro Urban N3, Dynabook Tecra A40-K, Microsoft Surface Laptop Go 2, Framework Laptop, MSI Prestige 14Evo A12M, Microsoft Surface Laptop Go 3, Dynabook E10-S, Microsoft Surface Go 3, Acer Aspire 5, Dell Inspiron 15, Acer Chromebook Spin 311, Asus Vivobook 15



BEST PREMIUM LAPTOP OR 2-IN-1

APPLE MACBOOK AIR 2022 (M2)

Solid M2 performance improvements, a sleek design overhaul, brighter and larger screen, returned Magsafe charger, and an unmatched battery life, all at a reasonable price.

HIGHLY COMMENDED

Microsoft Surface Laptop Studio Asus Vivobook Pro 16X OLED Asus Zenbook 14X Space Edition

FINALISTS

MSI G76 Stealth, Microsoft Surface Laptop Studio, Asus Zephyrus M16, Dell XPS 13 Plus, Apple MacBook Air M2, Dell XPS 15 (9520), LG Gram 2-in-1 16", Asus Zenbook 14X Space Edition, Fujitsu Lifebook U9312, Lenovo Slim 7 Pro X, Asus Zephyrus Duo 16, HP Envy x360 13.3-inch 2-in-1, Microsoft Surface Pro 9, Microsoft Surface Laptop 5, Asus Vivobook Pro 16X



BEST GAMING LAPTOP

RAZER BLADE 15

As thin as the LG Gram 16-inch 2-in-1 and 100g lighter than a MacBook Air 16, even with a Nvidia GeForce RTX 3080 Ti inside of it.

HIGHLY COMMENDED

Asus ROG Zephyrus G14 Asus ROG Strix Scar 17 SE

FINALISTS

MSI GE76 Raider, Asus ROG Zephyrus G15, Razer Blade 17 (2022), Alienware x14, Razer Blade 15, Asus ROG Strix Scar 17 SE, Asus ROG Zephyrus G14, Aorus 17, Asus ROG Zephyrus G15, Asus ROG Zephyrus m16, Asus ROG Flow Z13, Asus ROG Zephyrus Duo 16, Lenovo Legion 5i Pro Gen 7, Dell G15, Dell Inspiron 16 Plus 7620



BEST DESKTOP PC MAKER

PC CASE GEAR

This win comes primarily from PCCG's quality of service, build quality and testing regime for customer builds before shipping. Their range might not be the widest or very cost-effective, but you'll get a great system and be well looked after if you do buy one.

HIGHLY COMMENDED

Apple Aftershock PC

FINALISTS

Apple, MSI, HP, Mwave, Leader, PC Case Gear, Intel, Alienware, Nzxt, Lenovo, Acer, Aftershock PC

"2022 was the year of systems defying size expectations and breaking norms.

Whether it was Apple releasing a MacBook Air that's more expensive than a number of MacBook Pro devices, or Razer's Blade 15 with a 3080 Ti that's thinner and lighter than a LG Gram 16 2-in-1 and MacBook Pro 16, today's engineering is shrinking powerful components into unbelievably compact packages."

Peripherals and components

Through 2022 the transition from DDR4 to DDR5 as the new standard for most new motherboards took place, and initial scarcity and high pricing has given way to better value, lower timings and wide availability.

Air CPU coolers continue to hold strong in the face of the ongoing AIO assault, and our Labs were dominated by one company that we always thought of as just being all about value, but the quality was a very happy surprise and shows you don't need to spend over \$100 to cool a premium CPU.

Wi-Fi 6-routers really matured in 2022 and a few incredible models transformed the market. Top of the pile was Synology's RT6600ax router. The normally NAS-known company pushed hard with its flagship Wi-Fi 6 router and we quickly saw why.

The big news in monitors is QD OLED. As distinct from the non-QD OLEDs that first appeared, adding the Quantum Dot layer defeated OLED's big weakness, being a lack of brightness.

Keyboards, mice and headphones saw no huge evolutions in the last year, still, there are occasionally some interesting designs though style drives this segment more than others.

"The big news in monitors is QD OLED. As distinct from the non-QD OLEDs that first appeared, adding the Quantum Dot layer defeated OLED's big weakness, being a lack of brightness."



MEMORY MAKER

G.SKILL

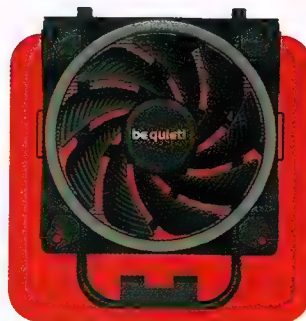
G.Skill can always be relied upon to push the boundaries of memory technology. But it's not all about raw speed. The company has some great value mainstream options too.

HIGHLY COMMENDED

Team Group

FINALISTS

PNY, G.Skill, Team Group, Corsair, Kingston,ADATA, Geil



COOLING PRODUCT

BE QUIET PURE ROCK 2 FX

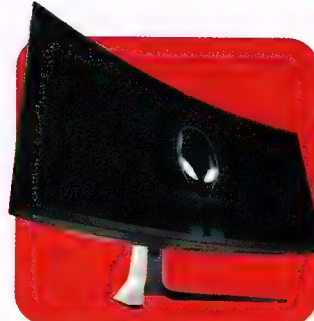
An air cooler? Yes! At a time when it seemed AIO liquid coolers would completely take over, this Be Quiet budget champion came along and impressed us with its cooling ability and excellent value for money.

HIGHLY COMMENDED

DeepCool LS720 (360mm) AIO

FINALISTS

DeepCool CK560, DeepCool AK400, DeepCool LE500 CPU Cooler, Be Quiet Pure Loop 2 FX, Be Quiet Pure Rock 2 FX, Thermalright Peerless Assassin 120 SE



MONITOR

ALIENWARE AW3423DW QD-OLED

This Alienware monitor features a Samsung panel with the first combination of brightness boosting Quantum Dot technology and contrast enhancing OLED to make an unbeatably vibrant ultra-wide screen with a 175 Hz refresh rate. WQHD resolution, DCI-P3 colour and a 1ms response time round out a pretty perfect feature set.

HIGHLY COMMENDED

BenQ Zowie 360Hz XL2566K

Samsung M8 Smart Monitor

FINALISTS

MSI Optix MAG281URF, BenQ Mobiuz EX3210R, Apple Studio Display, BenQ GW2785TC, Alienware AW3423DW QD-OLED, Samsung M8 Smart Monitor, Acer Predator XB323QK, Prism+ C315 Max, Dell 32 4K UHD Gaming Monitor G3223Q, Prism+ PG270 Ultra, Samsung 55" Odyssey Ark, LG UltraGear 48GQ900, BenQ Zowie 360Hz XL2566K, LG 27GP950-B



KEYBOARD

STEELSERIES APEX PRO MINI

The SteelSeries Apex Pro Mini Wireless is brimming with features, from its dual actuation capable keys to its customizable actuation points.

HIGHLY COMMENDED

Corsair K70 RGB Pro

DeepCool KB500

FINALISTS

DeepCool KB500, Corsair K70 RGB Pro, Asus ROG Strix Scope RX TKL Wireless Deluxe, Corsair K70 Pro Mini Wireless, SteelSeries Apex Pro Mini, Alienware AW510K



MOUSE

LOGITECH LIFT VERTICAL MOUSE

Not only does the wireless Logitech Lift ergonomic mouse put our hand in a more natural, neutral position to prioritise well-being, but it also offers a lot of productivity-minded features.

HIGHLY COMMENDED

Razer DeathAdder V3 Pro

FINALISTS

Logitech Lift Vertical Mouse, Razer Huntsman Mini Analog, Nzxt Lift, Logitech MX Master 3S, Corsair Katar Elite Wireless, Microsoft Modern Mobile Mouse, Razer DeathAdder V3 Pro, Asus ROG Chakram X



GAMING HEADSET

STEELSERIES ARCTIS NOVA PRO

With its multi-device-and-platform connectivity, long battery life, amazing comfort, and that excellent sound quality that Arctis headsets are known for, this is the one to get.

HIGHLY COMMENDED

JBL Quantum 610 Wireless headset

FINALISTS

SteelSeries Arctis 7+, JBL Quantum 610, Asus ROG Delta S Wireless, Alienware Tri-Mode AW920H, JBL Quantum 810, SteelSeries Arctis Nova Pro, HyperX Cloud Alpha Wireless



BEST RESELLER

PC CASE GEAR

In a year where GPU stock was hard to keep available, for gamers PCCG seemed to always have some stock available along with extra SKUs or different models that weren't available elsewhere, plus its PC builds are always competitive and well-balanced.

HIGHLY COMMENDED

BPCtech

Mwave

FINALISTS

Aftershock PC, Allied Gaming PC, Austin, BPCtech, Centre Com, Computer Alliance, CPL Online, IJK, JW, Mwave, PC Case Gear, PLE, Scorptec, TI Computers, Umart, MSY



CASE

FRACTAL DESIGN NORTH

Combining a unique wood-and-mesh front and lots of airflow-focused features at an affordable price, Fractal's North is a fantastic case with performance that's just as impressive as its looks.

HIGHLY COMMENDED

Nzxt H7 Flow

FINALISTS

Corsair iCUE 5000T RGB, Be Quiet Pure Base 500 FX case, Nzxt H7 Flow, Cooler Master Cosmos C700M, Corsair 1000D, Fractal Design North



ROUTER

SYNOLOGY RT6600AX

The Synology RT6600ax has every router feature a smart home or SMB could need including the ability to create 15 different SSIDs with different Firewall policies. It's one of the fastest Wi-Fi routers we've ever tested – with excellent range, too.

HIGHLY COMMENDED

TP-Link Deco XE75 AXE5400

Synology WRX560

Draytek Vigor2927ax

FINALISTS

Asus ROG GT-AX6000, TP Link Deco X73-DSL, Synology RT6600ax, Fritz!Box 4060, Mercusys AX1800, TP Link WiFi 6E Deco, Asus Zen WiF XT12 Pro, Draytek Vigor2927ax, Synology Router WRX560, Draytek Vigor2865ax

During the year of the Great Graphics Card Drought, Australian resellers did it tough.

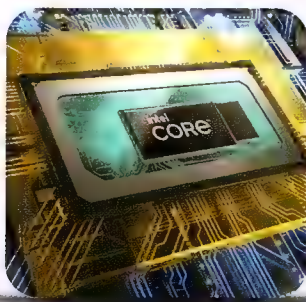
The struggle to get stock was one issue, while keeping customers with orders placed informed of an often heavily delayed delivery process was another thing they had to face – all while doing their best to get new customers in an era of stock scarcity and pricing inflation.

It wasn't just graphics cards, but that situation typified the challenges resellers faced in 2022. And, we were so impressed with how most of them handled it.

Communication and transparency was great to see, with many resellers having daily updated reports on stock and expected delays.

Through all of that they also had to keep at it with the regular business of building, selling and supporting new PCs and other gear. It was a tough year, but by and large they shone, and our hats off to the people at the front line doing their best to keep customers happy.

"The struggle to get stock was one issue, while keeping customers with orders placed informed of an often heavily delayed delivery process was another thing they had to face – all while doing their best to get new customers in an era of stock scarcity and pricing inflation."



Excellence

For the person, product or technology that advanced the PC more than any other in 2022

INTEL'S 12TH-GEN MOBILE CPUS

Despite all the supply chain issues and economic chaos, tech companies were actually able to deliver a wide range of seriously-impressive novel technologies in 2022. The APCA 2023 Excellence award is for the person, product or technology that progressed the PC the most in 2022 and whether it's AMD's vertically stacked CPU V-Cache or RDNA 3 chiplet GPU architecture; Nvidia's advances to powerful GPUs and next generation DLSS; or Apple's continuation of it's RISC processor range with the M1 Ultra, which outperformed all but one consumer CPU on the market at launch; there's no doubting that 2022 was huge for PC developments.

There were even more developments in updated Wi-Fi 6E networking technologies, the living room PC got perhaps its biggest flood of novel large-format monitors, and new game game streaming technologies all contributed to help people expand where and how they can use their computers. But while all these technologies were significant, there was one technology that made a bigger difference to the overall PC landscape than any other.

Intel's 12th generation notebook processors adopted a dual-type core structure, consisting of single-threaded efficiency cores and hyper-threaded performance cores that dramatically increased the number of cores Intel used in notebook CPUs and facilitated between nine and 37 percent performance bumps on chips all the way up to the Intel Core i9-12900HK. This is a major shift from the 10 to 15 percent year-on-year performance jumps we are used to seeing and allowed Intel to convincingly outpace AMD's offerings and compete, in many ways, with Apple's processors.

Intel is still the backbone of the vast majority of laptops out there, and so the major leap forward in 12th Gen CPU performance and efficiency effectively raises the bar for all notebooks in the space from lightweight tablet 2-in-1s to premium gaming workstations.

"Intel is still the backbone of the vast majority of laptops out there, and so the major leap forward in 12th Gen CPU performance and efficiency effectively raises the bar for all notebooks in the space from lightweight tablet 2-in-1s to premium gaming workstations."

HIGHLY COMMENDED

Microsoft PC Game Pass
QD OLED monitors
AMD Ryzen 7 5800X3D /
V-Cache

FINALISTS

AMD Ryzen 5800X3D /
V-Cache
Nvidia RTX 4090
Nvidia DLSS 3

QD OLED monitors
Apple M2 CPU
Wi-Fi 6E
10GbE LAN

Intel 12th-Gen Mobile CPUs,
Microsoft PC Game Pass
AMD Chiplet GPU
Apple M1 Ultra CPU

THE 2023 AUSTRALIAN PC AWARDS IS PROUDLY PRESENTED BY

AFTERSHOCK

ASUS

CORSAIR

dynabook

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G.SKILL

msi

PC
CG

SAMSUNG

"There's simply no weak area in any segment of Asus' wide range of products. It covers so many different areas and yet is able to deliver a big range of high quality gear giving consumers great choice, and a knowledge that whatever you buy from Asus will be well designed and made, usually with price-point options to meet every need and budget."



Gold

The company that impressed us the most, overall, in 2022

ASUS

The challenges 2022 imposed on a company delivering good consumer tech in 2022 were big ones. On one hand, we had all the excitement of new-gen products being launched that will shape PC performance for the next couple of years, but on the other, supply chain disruptions affected factory output, and the cost of making stuff and getting it shipped around the world.

Meanwhile, these companies had to continue the pace of innovation and deliver value. All a tough situation, no doubt.

As we reviewed the potential winners and discussed what did well, it became crystal clear that there was one company that succeeded more than any other. It's the same company that has won this award in the past, and it's Asus.

There's simply no weak area in any segment of Asus' wide range of products. It covers so many different areas and yet is able to deliver a big range of high quality gear giving consumers great choice, and a knowledge that whatever you buy from Asus will be well designed and made, usually with price-point options to meet every need and budget.

Asus scored more finalist nominations than any other company here, and by a huge margin. That's testament to the breadth and quality we've come to expect from Asus.

HIGHLY COMMENDED

MSI
Intel
Microsoft



Epic fail

2022's biggest loser

NFTs

What a banner year 2022 was for things that flopped. It's hard to recall a year richer in failure than 2022. So much so, that we have introduced the Epic Fail Award for the very first time. Our shortlist is a mind-boggling collection of promises made and not delivered upon. It includes terribly unfair things that happened to Australians. It is a finalist list that has comedy, and tragedy.

For some of these, we could all see the writing on the wall, and it was just a matter of time before the implosion. NFTs and the Metaverse count among those. In Australia we got two huge data hacks with Optus and Medibank, but we didn't get the Steam Deck... we couldn't get a graphics card without paying stupid money, and we briefly got an RTX 4080 12GB card before it was swiftly 'unlaunched' in a comically poor bit of marketing strategy from Nvidia.

But the gong goes to NFTs. It's rare that something so absurd has any degree of success, yet a great many people had faith that a picture that's not actually a picture has value. Jimmy Fallon and Paris Hilton got sued for spruiking them, Donald Trump got in on the action with a shamelessly low effort set of NFTs, and the market has now completely crashed. Well done NFTs, thank you for the laughs, and we're sorry if any of you lost money on these things.

Taking the Highly Commended is Mr Elon Musk. 2022 was one cluster of muck after another for Musk. His badly botched Twitter takeover is the main reason he's taking a prize today, but we can't help stare in awe at how he also alienated his customer and fan base through the year by embracing extreme political views, and burning all the fame and goodwill he accumulated over the last decade in one spectacular fall from grace in a few short months.

HIGHLY COMMENDED

Elon Musk

FINALISTS

NFTs

The Metaverse

GPU pricing and availability

Optus & Medibank hacks

Elon Musk

No Steam Deck in Australia yet

Google Stadia

Crypto currency

Nvidia RTX 4080 12GB Unlaunching



COVER FEATURE

11 WAYS TO REVIVE DEAD TECH

Don't let old kit clutter up your house or go to e-waste. Computer repair shop owner Lee Grant shows how to put it to good use.

Never let it be said that APC doesn't bring harmony to the world. This one article could clear clutter from your life, improve the quality of someone else's and help save the planet from impending ecological annihilation. Well, you can't accuse us of lacking ambition!

We've got ten inspirational ideas about what to do with all that old gear you've been squirrelling away. We want to help you get the maximum value from your purchases by re-purposing them in ways that can save you money. Why buy an external hard drive when a cheap caddy and screwdriver could turn your old laptop drive into the same thing for a fraction of the cost, for example?

We have information on how to donate your kit safely to people who are living in digital poverty, as well as opportunities to blow things up in your spare time. By the end, you'll see that buying new isn't always necessary, and as the environmental damage of most products is wreaked during the manufacturing process, we all need to find ways to re-use what we already own. Get ready to bring that pile of junk that you stub your toe on three times a week back from the dead.

1 REVIVE OLD PCS WITH CHROMEOS FLEX

It used to be obligatory within these sorts of features to advocate installing Linux onto an old machine, but at the risk of starting a riot, the quirks of penguin power are not for the faint-hearted. How about an intuitive lightweight OS, built by one of the world's largest companies, that actually works?



ChromeOS Flex is Google's latest freebie and can be easily installed onto PCs and Intel Macs, turning them into extremely capable Chromebook-like devices with access to Google Docs, Drive and all the Chrome extensions you could desire. What you don't get is access to the Google Play Store, but in an increasingly browser-based world, this won't be an issue for many users and you certainly shouldn't see it as a barrier to this very capable OS.

If you fancy a dabble, open Chrome on a working machine and download and run the Chromebook Recovery Utility (tinyurl.com/APC518chrome) extension, which will create a bootable USB installer. This software creates installers for most Chromebooks, so when the software asks to identify your Chromebook, choose Google ChromeOS Flex as the

Above: ChromeOS Flex works almost flawlessly on old PCs and Macs.

manufacturer and ChromeOS Flex as the product. The installer takes a long time to create, but once it's finished, it will install Flex extremely rapidly, giving you free entry to the Google eco-system.

The vast majority of Chromebooks are low-powered devices, so seeing Flex thrive on a spec designed to run Windows or macOS for the first time is as surprising as watching grandad clamber out of his chair and run a four-minute mile. Google has worked hard to make it compatible with a vast range of hardware and I've found its device detection success rate to be reassuringly high.

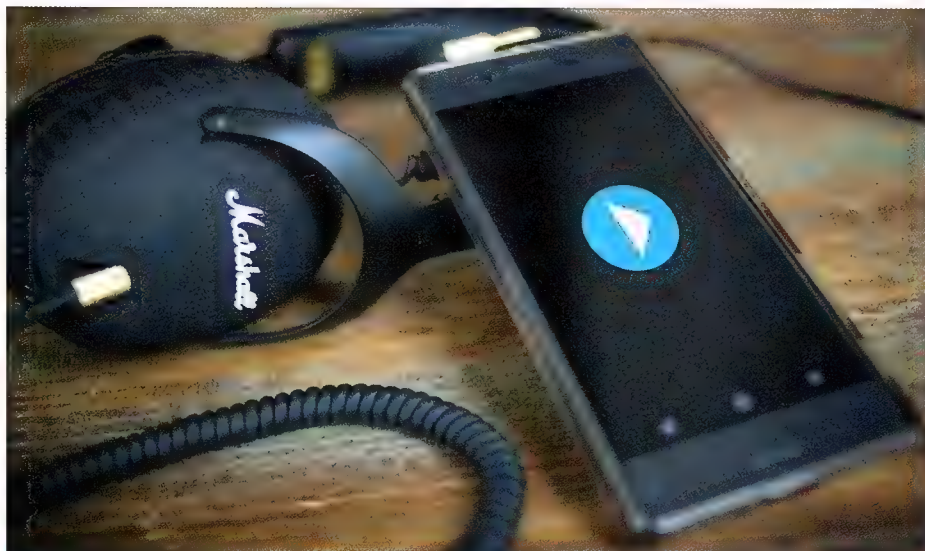
2 AN ANDROID JUKEBOX

It can be tricky to know what to do with an old mobile. One reason they fall out of use is that they stop receiving updates and support from the manufacturers, which makes them riskier to use, but also increases the chances of app updates failing.

This tip was inspired by a recent conversation with the teenage son of a customer about their music habits. I'd expected lots of subscriptions and streaming, but it seems there's a growing movement of fans who are dissatisfied with the quality of music on streaming services or have been moved to begin purchasing albums after hearing how little some artists receive for their work via streaming. In order to "stick it to the man", they're reusing old tech in an online/offline hybrid mode circa 2002.

Repurposing an old mobile to play music is made much simpler

Below: AutoSync turns your old phone into a music machine.





thanks to an app called AutoSync. It's not free, but \$9.99 buys you a lifetime licence to simply sync folders between your Android phone and some other storage, such as a cloud service or FTP setup. There are other ways of transporting files to and from an Android device but AutoSync is smooth and fast, and once the transfer is done, the phone can go offline with the music accessible to your media player of choice (mine is Musicole).

AutoSync isn't only about music. You can use it to load movies onto the tablets for the kids to play via VLC, or MP3 or M4B audiobooks via Listen Audiobook Player. With an easy method to sync offline files, streaming and subscription services may not seem so appealing.

3 PUT DRIVES TO WORK

I'll wager that many APC readers have at least one unused hard drive sitting in a cupboard, so let's put them to work. Icy Box (icybox.de) has a stack of products to connect an abandoned drive to a PC or Mac. A basic USB-3 Caddy is the simplest way of creating an external hard drive, which can always be used for backup, file transfers or the repository for Windows File History (tinyurl.com/APC518backup).

The German firm Inateck (inateck.com) manufactures a vast array of docks, which enable hot-swappable access to drives. Some of my clients use these to

Above: Stadia is on the way out, but the controller can still be put to good use.

prevent sensitive client data from cross-contaminating on a single machine.

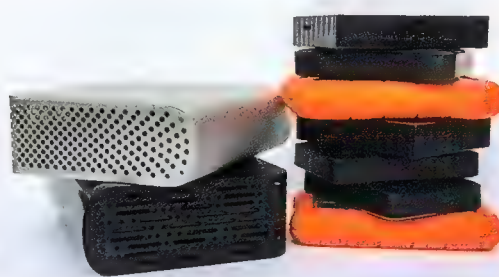
If you own a NAS or media server, then old drives are an obvious source of cheap storage, but please don't think this all relates to SATA connected drives. As people upgrade small M.2 SSDs, they can be re-used in exactly the same way, but with much greater speed.

4 GAME ON WITH YOUR GOOGLE STADIA CONTROLLER

If you were a Stadia subscriber, you'd be forgiven for hurling the controller into a cupboard when Google announced it was pulling the service from January 2023. But drag it out and dust it off, as it's not dead yet. You can repurpose the Stadia controller for PC gaming, and there are a few ways to do it.

With a bit of tweaking, Steam will identify the Stadia controller and allow you to use it on its vast array of PC and Mac titles. Launch Steam, then go to Settings, then

Right: Old hard drives can be repurposed to provide storage. (BY-SA 3.0).



Controllers. Connect a USB-C cable to the controller (the PC end can be USB-A or USB-C) and Steam will work out what's going on. Hit Controller Settings and select Generic Gamepad Configuration Support, ensuring that the options for PlayStation, Xbox and so on are unticked.

You can also calibrate the controller from here. Select the Big Picture Configuration or Desktop Configuration options to remap the controller to work as you'd like it in these modes.

"That's no good," I hear you cry. "I game while lounging on the couch, covered in crisps. My PC is 15ft away, I don't want a cable!" I hear you, but although Stadia controllers are wireless, Google reserved Bluetooth for setup, preferring to function via Wi-Fi. This poses a problem that we'll come to later, but I have a wire-free (ish) solution. A clever YouTuber called LateStageTech (tinyurl.com/APC518latestage) has developed an Android app called Wiredless Pro.

Download the required PC software (tinyurl.com/APC518server) and run ViEmBusSetup in either 32- or 64-bit flavour to suit your system. When you've finished doing that, dive into the corresponding WiredlessServer folder and run WiredlessServer.exe, which starts an emulator, fooling the PC into believing that an Xbox 360 controller is attached. Also open will be a CMD window listing an IP address (take a note of this). Connect the Stadia controller to the Android phone via USB, open the Wiredless Pro app, select Dinput and enter the IP address before pressing Connect. Stadia is wired to the app, which is wirelessly linked to the emulated Xbox 360 controller, and the PC can't tell the difference.

Although the Stadia controller remains wired to the phone, via the magic of Wi-Fi, the app talks to the PC, creating a wireless controller that's as responsive as using a cable. During my tests, the Stadia's trigger buttons didn't work, but you can remap buttons and work around that for some games. Just remember that the app must be active for it to work, but I bet you've got an old Android device that you can harvest for this one.

For Steam-less games that require button remapping, give REWASD ([rewasd.com](https://www.rewasd.com)) a try.

Stadia controllers were designed for their own platform and nothing else. Hopefully Google engineers will be able to release software to open up the controller's Bluetooth connectivity to make them compliant with many more platforms.

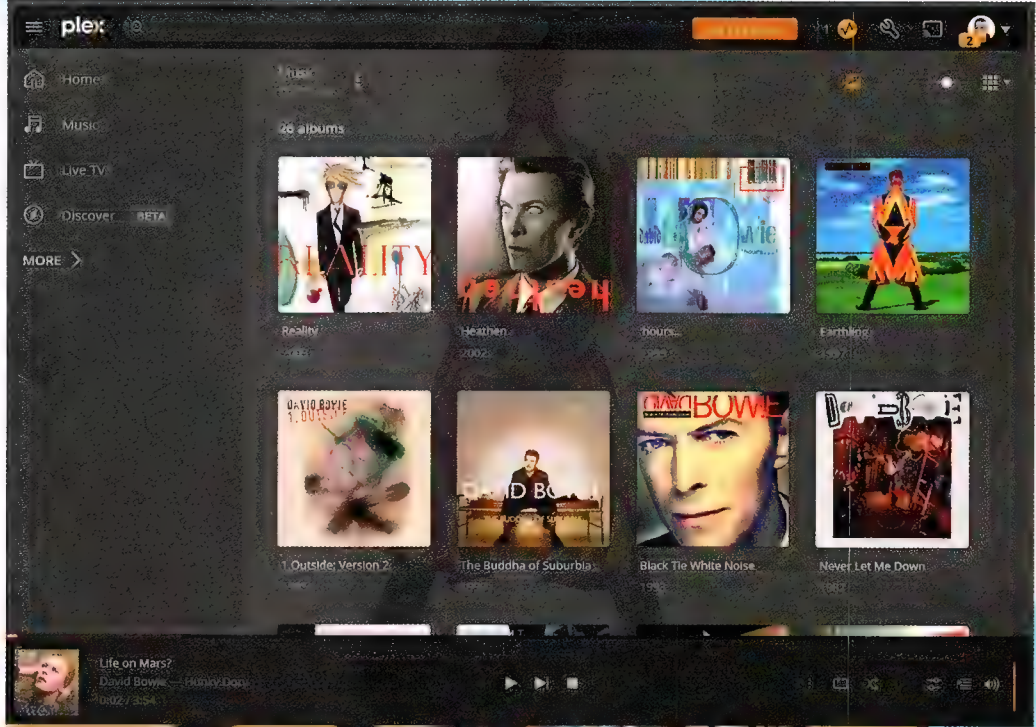
5 THE TINKERING RIG Getting hands on with hardware is not something everyone gets to do. A learning machine is about exploring the screws, clips and chips, getting up close to the ins and outs of hardware. Have you ever taken apart a laptop? Fancy reballing a GPU? A learning machine is one that you can strip down in order to experience the unbridled thrill of replacing components without being concerned if the magic smoke escapes.

The art of repair is becoming fashionable (and, hopefully, profitable) again, but you shouldn't learn how to perform a voltage injection and de-solder components on anything other than a machine where it doesn't matter if you break it. Although I've repaired tens of thousands of PCs, I'm mindful that repair can go horribly wrong, and the best preventative is experience. I implore you all to treat yourselves to an iFixit tool kit (tinyurl.com/APC518fixit) and learn how to fix things. You'll be amazed at how often you can bring tech back from the dead.

6 MAKE A MEDIA SERVER You'd be forgiven for thinking that media servers are unnecessary in a marketplace bulging with streaming services, but rolling your own system has much to commend it. With a media server, you can become your own streaming service, and it's the perfect project for an old PC.

My choice would be Plex (plex.tv) as it's easy to set up, can be accessed by almost every type of device you can imagine and handles movies, TV, music, photos and video. Plex Media Server (PMS) has such low system requirements that it can be run on a Raspberry Pi, but if your PMS will be simultaneously pinging media to multiple devices, a bit more poke would be useful.

PMS can be added to Mac, Windows or Linux, and if you're wondering what to do with that old NAS box, there are packages that will run on many brands. To



maximise my Core i5-4200 test machine, I've opted for Ubuntu and downloaded PMS straight from the software store. Once installed, simply access PMS from a browser at <http://localhost:32400/manage> and create a Plex Web account. Plex Web is a catch-all login, allowing you to manage the server from different devices and sync user accounts.

Plex prompts you to create your media libraries by asking where the data is to be stored and, well, that's about it for a basic setup. These settings can be tweaked later, so I retreated to Ubuntu and loaded my Music library folder

Top: Create your own media server with Plex.
Above: Taking apart an old PC is a great way to learn how it all works.

with albums, which is where Plex requires some thought. There's a whole section (tinyurl.com/APC518plex) about organising media to give Plex the best chance of identifying or cataloguing your files and what to do when it finds four different versions of Star Wars.

To access your PMS, there are apps available for Apple TV, Chromecast, Amazon Fire TV, Roku, iOS, Android, most Smart TVs and probably Etch-a-Sketch. Plex is designed so you can access your media from any location, but access from outside your network can easily be turned off in Settings | Remote Access.

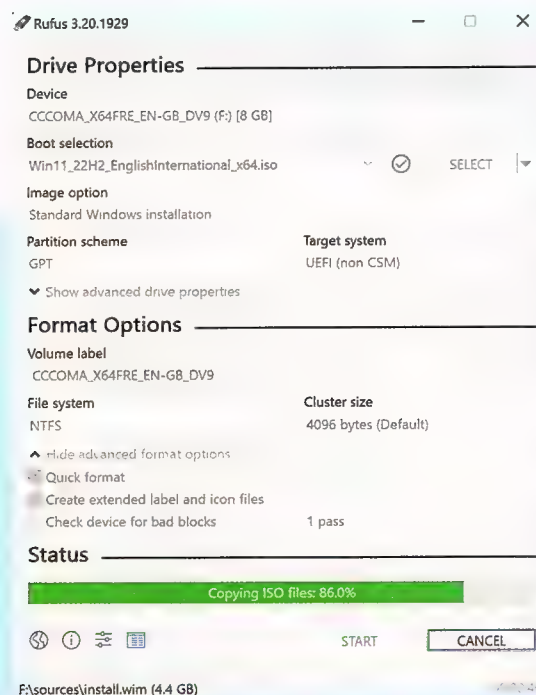


Above: Your old kit can help relieve digital poverty.

Plex has a barrel of other features, enhanced by its Plex Pass subscription which unlocks even more, including device downloads, parental controls and Plex-amp, a custom player for audiophiles. Although the streaming platforms claim to offer “what you want, when you want”, media content is frequently pulled and alternative versions of your favourites, missing that bit you really like, are substituted in. Plex puts the control back into your hands.

APC Health Warning: Obsessively cataloguing a digital media collection can lead to missed meals and family arguments. Please tag responsibly.

Above: Building a NAS device isn't as tricky as you might think.



7 DONATE OLD TECH

Donating tech to someone who needs it can be life changing. Figures from the Digital Poverty Alliance state that one in five children who were home schooled during the pandemic didn't have access to an appropriate device, such as a laptop. Before anything leaves your hands, secure yourself by erasing the drives with Killdisk Free for macOS, Linux and Windows (killdisk.com) or by performing factory resets on tablets, phones and consoles.

Norton (tinyurl.com/APC518norton) has an excellent list, of organisations that can help find new owners for your usable tech. There are people and families countryside stuck in digital poverty, so ask around locally at schools and community centres to see if your unused kit can be useful to someone else.

8 BUILD YOUR OWN TRUENAS

For most of us, data storage is a messy business with files strewn across drives as if a hand-grenade has gone off in a filing cabinet. Multiple drives merely multiply the pain. If this sounds eerily familiar, then network-attached storage (NAS) is something I'd encourage you to consider.

TrueNAS is a storage OS capable of creating a scalable, professional-grade NAS system on modest hardware. TrueNAS is known for its enterprise products, but Core (formerly FreeNAS) is free and retains key features such as the OpenZFS file system, snapshots, replications, enhanced security, virtualisations and plugins.

It requires a twin-core 64-bit Intel or AMD CPU, 8GB RAM, Ethernet (no Wi-Fi), 16GB or larger SSD boot device and storage to host the files. Just note that TrueNAS's multiple-drive storage pools require hard drives of the same capacity. Download the .iso (www.truenas.com/download-truenas-core/) and either create a bootable USB using Rufus (rufus.ie) or burn a bootable DVD and use that to boot the machine. Select Boot TrueNAS Installer, then go and make a cup of tea while the magic happens.

When the Console Setup window appears, select Install/Upgrade, choosing the drive from which TrueNAS will boot from (that is, not the drives for your storage pool). You'll be reminded that everything on the drive is going to be wiped, so don't try this on your day-to-day PC, but the old machine you don't know what to do with.

Once you've entered a root (administrator) password, choose a boot mode that matches your BIOS setup, then create a 16GB swap file. The system will thrash away and demand a reboot. Once this happens, select Boot TrueNAS (or wait five seconds) and the machine will tidy up a few things then drop into Console Setup, displaying an IP address. This is the gateway into the NAS for other machines on the network, so entering root as the username along with the password you chose during setup will reveal the option-packed Web-UI.

The TrueNAS website is packed with video tutorials, documentation, a community forum and a Discord channel to help you configure and tweak, which is fortunate as there isn't

enough space in APC to scratch the surface.

NAS systems work how you want them to. Once a storage pool is defined, you have nothing more than a large external drive, but click on System then Cloud Credentials to get TrueNAS to talk to a stack of cloud providers including Amazon, Mega, Microsoft OneDrive and Google Drive. Dig around in Tasks, then Cloud Sync Tasks, and your files could sync to the cloud while you're asleep. Fancy a bit more? Two minutes in Plugins and I'd installed a Minecraft server and a Drupel webdev setup. Not bad for free!

9 THE SOFTWARE TEST BED

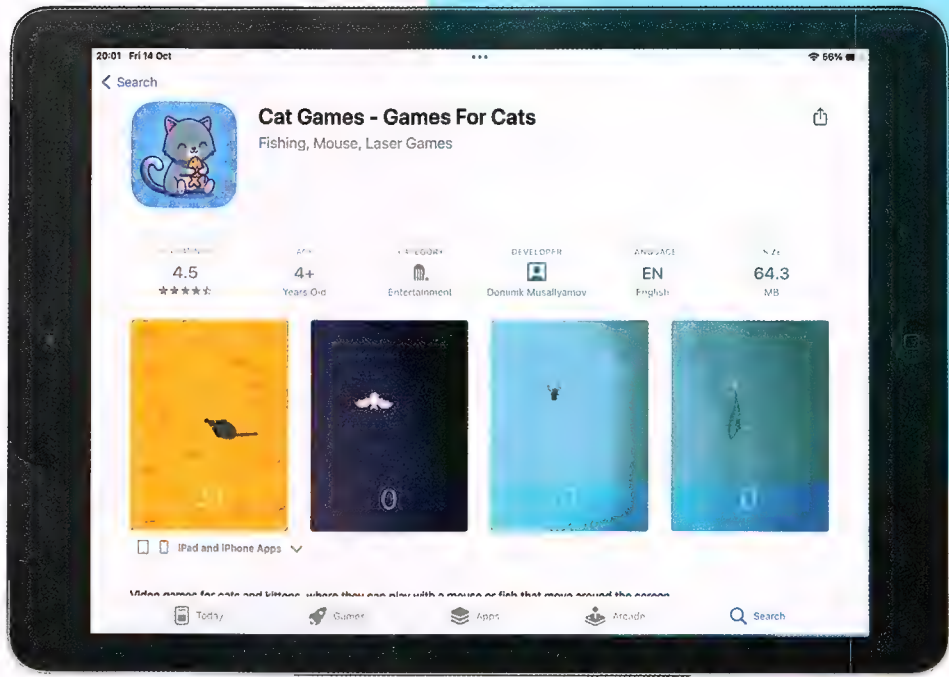
We always pack APC with great tips designed to help you squeeze the most from a machine, but it may not always be convenient to hijack the family laptop to get hands on with our hot list of recommended Python debuggers. What you need is an experiment machine. A box purely for messing about with, one which can be thrashed, crashed and rebuilt, while you're safe knowing that the day-to-day machine will still boot in the morning.

Obviously, it's possible to do marvellous things on virtual machines, but sometimes life is too short for faffing about with serial port emulations. If you've always wanted to try coding, then this is for you. Use one to learn Linux or upscale VHS into 4K while finally becoming the champion at the Shufflepuck Café and perfecting that tricky three-point lighting setup in Blender. Old tech offers so many possibilities to learn something new.

10 ANNOY APPLE BY BUILDING A HACKINTOSH

You're a APC reader. I know you dabble with technology, seeking the euphoric feeling when something finally works. This tip can do that. It's not for the faint-hearted or for those that are easily flummoxed and frustrated, but the merest mention of the word Hackintosh can bring even the hardestie techie to their knees.

In simple terms, Hackintoshes are non-Apple machines that, with a lot of tweaking, run macOS. Like desktop PCs, they're repairable, adaptable and upgradable, providing an alternative to the



Above: Give Kitty the iPad experience with Cat Games.

official solder-machines on sale, but they're difficult to build. Take yourself to the r/hackintosh group on Reddit (reddit.com/r/hackintosh) and read through their exhaustive FAQ.

Thanks to Acidanthera's OpenCore platform (github.com/acidanthera/OpenCorePkg), it's now possible to build a fully operational and robust Hackintosh with many standard PC parts and run most versions of macOS, right up to Monterey (version 12).

The legality of Hackintoshes is interesting as they break the macOS EULA, which basically states that you can't run any Apple OS unless it's on Apple hardware or a VM running on Apple hardware. Hackintoshers argue that it's not illegal because they download legal software from Apple, or use their own Macs and the devices are for teaching and personal use. Either way, it raises questions about the rights of ownership that are complex and challenging, and

Below: Hackintoshes are non-Apple machines that, with a lot of tweaking, run macOS



if humanity always shrugged when faced with difficulty, then Michelangelo would have only painted the floor of the Sistine Chapel. A Hackintosh is both a technical challenge and a symbol of rebellion. Vive la révolution.

11 REBOOT THE IPAD

With over 500 million iPads sold, there's a chance you have one wedged in the back of a drawer doing nothing. Why not put their splendid screens to work as a second monitor for a laptop?

Splashtop Wired XDisplay (splashtop.com) is compatible with iPads that didn't get past 2013's iOS 7. A standard USB charging cable allows Apple's finest to extend or mirror a PC or Mac at up to 1080p and 60fps. It's not free, costing around \$20, but it works well, and an iPad doesn't add much weight to your laptop bag.

Taking a sharp left turn, we have Cat Games, which are... games for cats. There are many of these in the App store, but they all essentially let Tiddles loose on your old iPad, batting the meandering fish or squeaky mice that scurry across on the screen.

For little ones with fewer than four legs, there's Luna, which converts two iPads or iPhones into a baby monitor. It works over mobile and Wi-Fi and Luna claims it will run on anything newer than an iPhone 5 or second-gen iPad (or iPad mini). The core functions are free, but there are optional in-app purchases. Just don't mix the Luna iPad up with the cat's, otherwise you're in for one heck of a night. ■

FEATURE - PART 4

(R)evolution of Portable Audio: The world goes digital

Not even the Sony Walkman could shield analog audio from the future, but the key technology that launched the Compact Disc first appeared in a telephone during World War II. Darren Yates explains.

COMPACT disc DIGITAL AUDIO

Above: Compact Disc Digital Audio was the right product at the right time (Public Domain).

Right: The first commercial digital audio recorder was an adapted Betamax VCR (Image credit: Franny Wentzel, CC BY-SA 3.0).

Alec Reeves had sadly passed away by the time global tech giants Sony and Philips jointly launched the Compact Disc in 1982. The optical disc that brought the world digital audio for the first time may well seem to be an invention of its time, but digital audio more broadly, and the Compact Disc in particular, owe much of their success to technology that was first used during World War II to secure secret phone calls between British Prime Minister Winston Churchill and U.S. President Franklin D. Roosevelt. Today, digital audio seemingly permeates almost every technology device, but like a good many inventions, it owes its existence to engineers whose names deserve greater recognition.

Pulse Coded Modulation

The son of a surveyor, Reeves was born in Surrey, U.K. in 1902 and graduated as an electrical engineer from Imperial College, London at just 19. He moved to Paris four years later to work in the laboratories of the fast-growing International Telephone and Telegraph (ITT). Reeves amassed an impressive 82 patents during his lifetime, yet it's debatable that any were more influential to the future of digital audio than one awarded in 1938, the rather-plainly titled 'Electric Signalling System'.

Improving audio quality, in particular reducing the



background hiss in audio (improving the Signal-to-Noise Ratio or SNR), was a key battleground during the 1960s and 70s, leading to new noise-reduction technologies such as Dolby NR and dbx. But it was a battle first fought way back in the 1930s around the world as telecommunications rapidly expanded.

Long-distance phone calls during that era were typically sent through a series of repeater stations. The voice audio was

converted into an analog electrical signal and transmitted, whether travelling hundreds or thousands of kilometres over cable. However, over such distances, that signal would drop in strength and require repeater stations at regular intervals to amplify that signal back up before heading off onto the next leg of the journey. The problem was each amplification step also increased the background noise (reduced the SNR) and reduced the quality.

It was for this problem that Reeves figured out a radical solution that involved converting the audio into a series of digital binary pulses that could be easily transmitted and boosted as necessary. Then, once at its destination, the digital signal could be converted back to the original audio without the usual loss of audio quality. The solution was dubbed 'pulse coded modulation' (PCM), for which, Reeves received a patent in 1938.



Right: The world's first CD player, the Sony CDP101 (Image credit: Atreyu, CC BY 3.0).

Unfortunately, his idea was ahead of its time – certainly ahead of the electronics and thermionic valves or ‘tubes’ then available. In the end, the U.S. Bell Laboratories incorporated the first practical PCM audio system in 1943 into the encrypted speech system called ‘SIGSALY’ used for secret communications between Churchill and Roosevelt during WWII.

Transparent discs

It wasn't until 1958, however, that the other half of the 'compact disc' equation – the physical disc media itself – began taking shape. David Gregg, an electrical engineer working for U.S. electronics company Western Electric, developed a transparent optical disc that used light transmission through a disc to store electrical signal data. He patented his optical disc design in 1962 and formed his own company – Gauss Electrophysics – to further the technology. What's interesting is that the disc was designed to store analog VHS-style video – the first commercial digital video disc format was still 25 years away. The industry giant MCA (Music Corporation of America) eventually bought the patents to the disc technology in 1968 with a view to further improving and commercialising it.

Digital audio recording

Back in the audio world, transmitting secure phone calls as digital audio was one thing, but it was an entirely different matter to record digital audio onto some form of storage media. Reel-to-reel audio tape during the 1960s managed to reach 20kHz of bandwidth at reasonable tape speeds, but it would need a bandwidth 100 times that to accurately capture a PCM signal good enough to replay as music. It's a bigger story for another time, but the solution already existed in the form of the video tape recorder. These professional devices, often still the size of a fridge in the mid-1960s, were recording TVs signals with a bandwidth of up to 5MHz – all that was needed was for someone to come up with the right idea. That 'someone' was Heitaro Nakajima, an electrical engineer working for the Japanese Broadcasting Corporation known as 'NHK'. In 1967, he developed the first PCM digital audio converter to attach to



a video tape recorder. The system converted audio into a 12-bit binary data stream with a sample rate of 30kHz. Thanks to a theorem developed by another engineer, Harry Nyquist, that 30kHz sample rate enabled the recorder to capture analog signals up to 15kHz. The 12-bit binary stream was potentially sufficient to deliver a dynamic range (loudest sound to smallest) of 72dB (about 4,000:1), an improvement on analog tape at the time.

That original system created by Nakajima was a mono (one-channel) system only, but by 1969, a stereo system had been built. Three years later, Japanese electronics firm Denon produced the first commercial digital audio recording using the recording system Nakajima had developed for NHK.

Nakajima quits

Nakajima had joined NHK not long after completing his engineering degree in the 1940s, but he continued his studies, receiving a Doctor of Engineering

degree in 1958. His success in developing the digital audio recording system in 1968 soon had him on the radar of one Masaru Ibuka, better known as co-founder of Sony. After some gentle encouragement from Ibuka, Nakajima quit his job at NHK in 1971 and walked through the front door of Sony as the new boss of the Audio Technology Centre. Another piece of the Compact Disc puzzle had just fallen into place.

"These professional devices, often still the size of a fridge in the mid-1960s, were recording TVs signals with a bandwidth of up to 5MHz – all that was needed was for someone to come up with the right idea."

Philips improves the optical disc Meanwhile, the late-1960s were proving to be a fertile period for Dutch giant Philips. In the race to create a video disc playback system, Philips engineer Klaas Compaan came up with a new

reflective disc design that offered improvements to Gregg's transmissive disc (including more compact design). In 1972, Philips joined forces with MCA to showcase a demonstration 'video disc' system, but it would take another six years before 'LaserDisc' would make its world introduction in 1978.

However, those six intervening

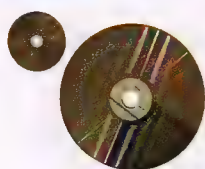
Above: Japanese audio brand Denon recorded the first commercial digital audio in 1972 (Image credit: Pittigrilli, CC BY-SA 4.0).



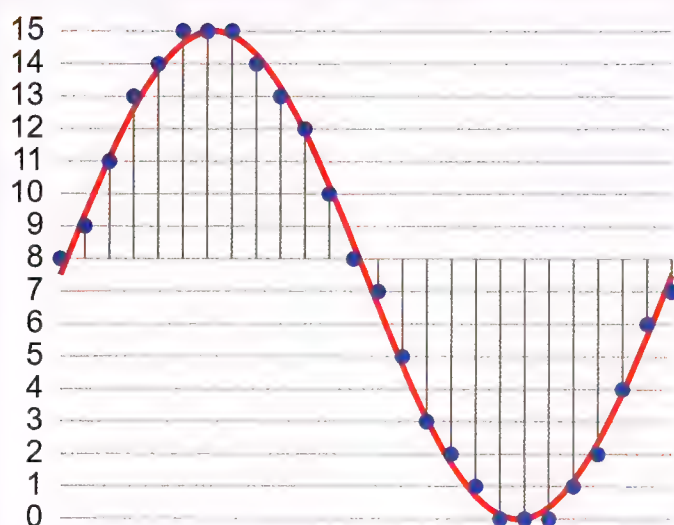
Above: CDs consist of four layers, with data read from the thin metal storage layer (B) (Image credit: Pbroks13, CC BY-SA 3.0).



Left: Philips went to market with its first CD player, the CD100, in 1983 (Public Domain).



Above: LaserDisc stored analog video on optical discs 30cm in diameter (Image credit: Kevin586, CC BY-SA 3.0).



Left: PCM converts continuous analog audio voltages into discrete (fixed-rate) digital samples (Image credit: Aquegg-commonswiki, CC BY-SA 3.0).

years were crucial, for during that time, the VCR battle had begun and as a result, LaserDisc would struggle to compete in the market. It would ultimately take another couple of decades before the market was ready for an optical disc format for video...

Betamax: the first digital audio recorder

In the meantime, Sony recalls Nakajima's first two years were somewhat subdued, with the company deciding to get out of the expensive LSI (large-scale integration) chip business (albeit temporarily) in 1973. Nevertheless, that same year, Nakajima and his team were reportedly just far enough away from 'head office' that they could work more or less without interference – and so with little fanfare, they got to work on a digital audio recorder. The result was dubbed the X-12DTC – it worked, but required two-inch (5cm) wide tape and reportedly was the size of a fridge. Sony showed off the machine at the 1974 Japan Audio Fair, but that's as far as it went.

However in 1975, the Sony

Betamax video cassette recorder (VCR) hit the market. Being a consumer-grade device, it didn't match the bandwidth of professional video recorders, yet the Betamax VCR still had a recording bandwidth of 3.2MHz – it was this fact that twiggled team member Agira Iga into wondering could the far-more-compact Betamax be made to record digital audio. They still needed to design a PCM adapter unit to convert the original audio signal into a digitised video-like signal the VCR could handle, but the following year, the PCM-1 PCM Processor was born and combined with the Betamax VCR, became the first commercial digital audio recorder. However, the PCM-1 reportedly also copped flak from some users for producing weird 'humming' noises that would require additional research for Sony to eventually overcome.

What about PCM and LaserDisc?

It was now 1976, the year the VCR format war kicked off, as JVC launched its 'VHS' system to take on Sony's Betamax. However, even at this stage, Sony had signed up

to its next bet, the Philips-MCA optical disc system. Again, the idea of applying PCM digital audio, this time, to a LaserDisc player was floated and by the end of 1977, Sony had constructed a 12-inch (30cm) LaserDisc disc that played only digital audio. While a normal 30cm-diameter LaserDisc was good for as little as 30-minutes of analog video, this PCM audio disc could, in theory, hold an impressive 13 hours 20 mins. Not surprisingly, such a large disc capable of so much audio-time raised a few questions.

Sony and Philips meet

They say 'timing is everything' and it was in the northern-hemisphere summer of 1978 when Sony received an invite from Philips engineer Lou 'Compact Cassette' Ottens to come and view a new little optical disc the company was working on. As it turned out, Sony wasn't alone in the idea of an optical digital audio disc – the new Philips disc was 11.5cms and reportedly good for one hour's recording. According to Sony, they saw the value of it immediately and an agreement was forged between the two companies to commercialise the disc, with work beginning in August 1979.

While these two tech titans clashed over the Compact Cassette a decade before, they'd actually maintained a successful working relationship for the better part of two decades to this point. What's more, this new venture was essentially the ideal collaboration – Sony's expertise in digital audio was now second-to-none and Philips' reflective optical disc was exactly the tech needed.

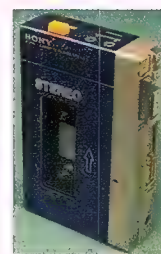
The 'Compact Disc'

As with most relationships, there were squabbles along the way (including deciding on the audio bit

Right: In 1995, Sony dropped the 'Discman' name in favour of its 'CD Walkman' brand (Image credit: Lcarsdata, CC BY-SA 3.0).

Far Right: Initial Sony portable CD players were branded 'Discman' and evolved during the 1990s (Image credit: MiNe, CC BY 2.0).





Above: The first portable CD player arrived just five years after the first cassette Walkman (Image credit: Binarysequence, CC BY-SA 4.0).
Left: The WWII 'SIGSALY' encrypted telephony system was the first use of digital PCM audio (Public Domain).

depth and the size of the disc itself). However, a more pressing issue was development of the laser pickup unit and the LSI chips to handle new complex concepts such as data error-correction. Nevertheless, prototypes of the new 'Compact Disc' system began appearing in 1981. The two partners had finally settled on a 120mm-diameter optical disc delivered stereo (two-channel) digital audio with a sample rate of 44.1kHz at 16-bit depth and a maximum run-time of 74mins 42seconds.

The problem now was convincing the record labels it was a good idea. Not surprisingly, a good number were against it to begin with, since LP records had improved significantly over the previous decade (not to mention the cost spinning up brand-new CD production would require).

In the end, however, they came on-board and on 1 October 1982, with much fanfare, Sony launched the world's first CD player, the CDP-101, alongside a CD copy of Billy Joel's 52nd Street, one of 50 CDs launched on the day, all manufactured by Philips.

CDs go portable

The difference in audio quality between the Compact Cassette and Compact Disc was instantly

recognisable – to the extent that Sony's Walkman, while still hugely popular, had a major new technology competitor to deal with. Not surprisingly, the desire to do with the Compact Disc what they had achieved with the Compact Cassette became a mandate for Sony to shrink the CDP-101 into something akin to the Walkman.

However, while shrinking an analog cassette tape system was one thing, shrinking digital technology that included PCM digital-to-audio

decoding, error correction and did so using only battery power was something else. The key would be LSI chip design. According to Sony, while LSI had made the CDP-101 a reality, the rapid scale of development at the time meant that by September 1983, it could build the CDP-101 into a box one-tenth of its original size. In November 1984 and with the rest of the technology miniaturisation complete, Sony launched the D-50, the world's first portable CD player and dubbed it the 'Discman'.

The phenomenon continues

Today, the vast majority of digital audio we listen to features some form of lossy compression, whether it's MP3, AAC or whatever. However, that compressed audio, especially if its music from your favourite band, will invariably have started its digital life as a PCM stream of data recorded onto a storage format.

PCM still remains the pre-eminent form of digital audio and continues to be used to store archive-quality recordings. It's not known whether Alec Reeves knew of

the work Denon or even NHK had achieved in PCM recording before he passed in 1971, but you'd think he'd have been just a little bit chuffed.

In the next installment of this series in APC we're heading into the 1990s as digital audio takes over and portable devices appear in all forms, but as a new century dawned, few would be prepared for a once-struggling computer company fast finding its feet again to create the next revolution in portable audio. ■

"It was now 1976, the year the VCR format war kicked off, as JVC launched its 'VHS' system to take on Sony's Betamax."

BEST NEW PC SKILLS YOU SHOULD LEARN TODAY

There are always new tricks to master to help you keep up with the latest technology. *Robert Lewis* suggests 16 ways to expand your digital skills and the best free tools to use.

WHAT YOU CAN DO

- Make your video calls better quality
- Secure and schedule email messages
- Manage files on your PC like an expert
- Improve your Wi-Fi and Bluetooth capabilities
- Capture audio and video from any source
- Take control of your Windows software

In December, BT published research that highlighted the importance of learning new digital skills among the older generation. Its report (see www.snipca.com/44641) found that 39 percent of older adults feel they aren't 'tech savvy', but are still keen to master new technology. It listed 40 digital skills that the over-60s have learnt in the past 10 years, which ranged from basic everyday activities such as online shopping, taking photos on a mobile phone and streaming TV shows to more advanced tech tasks including connecting to Wi-Fi, setting up a VPN and using QR codes.

Most APC readers should comfortably be able to tick off all 40

items in BT's list, but technology is constantly evolving and there are always new skills to learn if you want to keep up with the latest changes. In this feature, we recommend 16 secret PC tricks you should master to expand your digital expertise.

We reveal how to perform activities you're already familiar with in a faster, smarter and safer manner, and suggest the best free software for these tasks. To keep things fresh and forward-looking, these all involve using new programs or tools that have been introduced in the last 12 months. Once you've mastered these skills, you can pass on that knowledge to your less tech-savvy friends and family members.

IMPROVE YOUR VIDEO CALLS

1 Enhance the quality of your video calls

During the Covid lockdowns, millions of us discovered the benefits of making video calls on our PCs. Software such as Zoom, Skype and Google Meet lets you have free face-to-face chats with friends and family anywhere in the world, so you can stay in touch when you can't meet in person, and make group calls to several people at the same time.

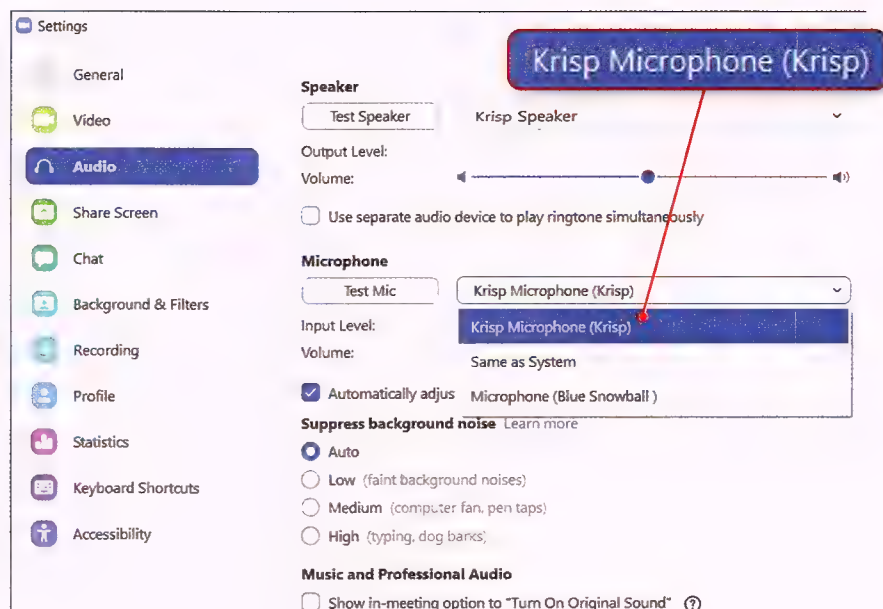
However, a common problem with desktop video calls is poor sound quality. Provided you and the person you're speaking to have decent webcams and are sitting in adequately lit rooms, you can usually see each other without any problems, but you might not be able to hear each other properly. Muffled audio, background noise and echoing voices can all affect the clarity – and your enjoyment – of the conversation, almost as much as accidentally muting your microphone.

To ensure all your future video calls are suitably clear and audible, install Krisp ([krisp.ai](https://www.krisp.ai)) on your computer. This program uses AI to remove background noise and echo from video calls, and enhance the quality of your voice. Specify which video-chat tool you use, from options including Zoom, Skype and Microsoft Teams, and Krisp will provide instructions for setting it up with that service.

In Zoom, for example, click the Settings cog in the top-right corner, choose Audio and select Krisp Speaker and Krisp Microphone from the Speaker and Microphone dropdown menus (see screenshot above right) - Zoom offers its own 'Suppress background noise' option, but Krisp works better. Next, in the Krisp software, ensure your computer's default microphone and speaker are selected, and that Remove Noise is switched on for both. You can test the noise reduction by clicking Test Noise Cancellation and recording yourself speaking.

When you start or join a video call, you'll see a Krisp widget above the chat window, which shows that noise reduction is active – you can switch it off if necessary and launch Krisp manually if the widget doesn't appear.

Krisp is free for personal use and works for 60 minutes of video calls per day. If you need unlimited use, you can upgrade to a Pro subscription for US\$8 per month. You need to register with Krisp before you can download its software to your PC, but no payment card details are required.



Enhance the quality of video calls by using Krisp to remove background noise.

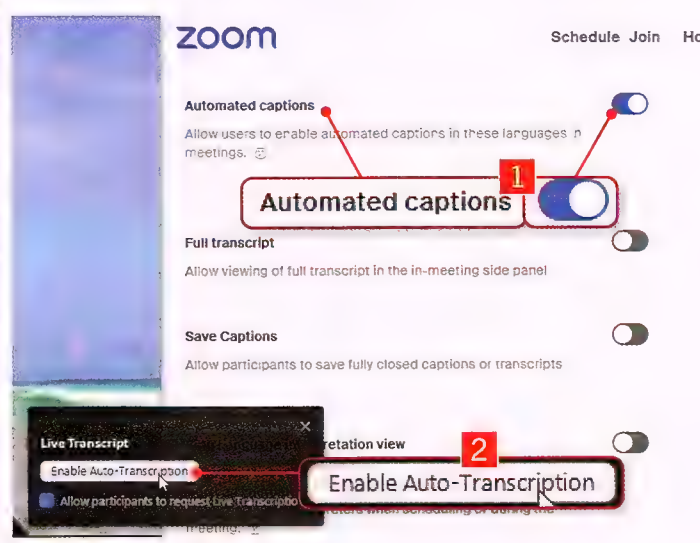
2 Display live captions in video calls

Even when the sound in your video calls is relatively clear, you may not catch every word people say and vice versa, especially if one of you suffers from hearing difficulties. This is why it's useful to know how to enable live captions for your video conversations. As with subtitles on TV programmes, this feature transcribes speech in almost real time, so you can read what other chat participants are saying even when you can't hear them.

Zoom used to reserve automatically generated captions – or Live Transcription as it calls the feature – for its paid-for business plans, but now they're available to free users, too. When you're hosting a video meeting, you can activate the option by visiting your Zoom Settings page at www.snipca.com.

[com/44604](https://www.snipca.com/44604) and selecting 'In Meeting (Advanced)'. Switch on 'Automated captions' (1 in our screenshot below) and optionally 'Full transcript' (which allows participants to view the full transcript in a side panel) and Save Captions (which lets people save captions and transcripts). In the Zoom video-call window, click the Live Transcript button (or the More button if you can't see this) and choose Enable Auto-Transcription (2. Chat participants can also request that the feature be turned on.

Skype makes displaying live captions much easier. During a video call, select the Caption button to turn on the feature, then click it again to customise the caption settings. You can choose to show captions for all the people you're currently talking to, or for other participants but not yourself, and control where they appear in the call window.



Activate automatic captions so nobody misses a word of your video calls.

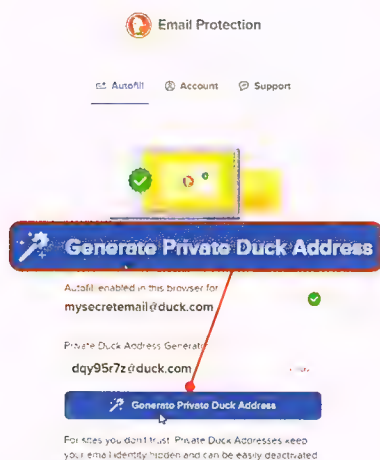
TAKE CONTROL OF YOUR EMAIL

3 Disguise your email address to stop spam

Sending an email is one of the first digital skills most of us learn, but protecting your email address from junk messages requires expert know-how. In the past, the easiest option was to use a disposable email service, but this made it difficult to retrieve messages containing important information and to reply to emails.

A much smarter way to avoid spam, scams and data leaks due to security breaches is to use DuckDuckGo's Email Protection service. Launched last August, this gives you an alternative '@duck.com' email address that you can share with websites. The service then forwards messages to your usual inbox without revealing your real address. Unlike rival services, it lets you create an unlimited number of fake addresses for free, so if one of them starts forwarding junk to your inbox, you can simply switch to a new one. It also lets you reply to messages sent to your Duck (@duck.com) address.

To use DuckDuckGo Email Protection on your PC, install the DuckDuckGo Privacy Essentials extension for Chromium browsers (www.snipca.com/44608) and Firefox (www.snipca.com/44607) – note that this changes your default search engine to DuckDuckGo. Visit the DuckDuckGo Email website (duckduckgo.com/email), click Get Started and follow the instructions to set up your first Duck address. You can create subsequent addresses either by clicking the extension's toolbar button and choosing Generate Private Duck Address or clicking that option on your account page (see screenshot below).



Disguise your email address by creating a Duck address to share with websites.

4 Encrypt your private emails

One of the best features in Mozilla Thunderbird (www.thunderbird.net/en-US) is the ability to secure your emails using end-to-end encryption, so that only you and the recipient can read them. The latest version of the email program (102) makes this even easier to do.

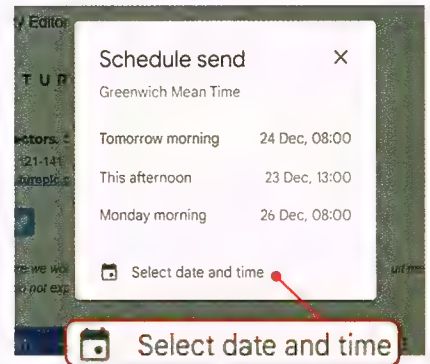
To enable the option, click the three-line menu button in the top-right corner of the main Thunderbird window and choose Account Settings, then select End-to-End Encryption. You now need to create an encryption key for your emails using the secure OpenPGP standard. Click 'Add Key' (see screenshot below), select 'Create a new OpenPGP key' and click Continue. Choose your email address in the Identity menu, specify how many years your key should work for – or select 'Key does not expire' – and click 'Generate key'. Click 'Confirm' and Thunderbird will generate your OpenPGP key, which consists of a public and a personal part and will appear in the OpenPGP Key Manager.

To send someone an encrypted message, you first need them to email you their public encryption key. Open the email containing this key and double-click the attachment that ends in '.asc'. Click 'Import' to save the key in Thunderbird. Once this is done, click the Write button or press Ctrl-N to compose a new message to that person. Click the Encrypt button if it isn't already selected, then type and send your email. Your own public encryption key will be automatically attached to the email, so the recipient – and nobody else – can decrypt it and read its contents.

You can share your public key with people you haven't securely messaged before by clicking the arrow next to Attach and selecting My Open PGP Public Key. They will then receive an email attachment



Create an OpenPGP key in Thunderbird to secure your emails using encryption.



You can schedule emails for Gmail to send later at a more appropriate time.

containing the encryption key, so they can reply with their key and send you encrypted messages. It's simpler than it sounds and is an important skill to master if you value your privacy.

5 Schedule emails to send later

Unlike in France, where employees can legally ignore work-related emails outside office hours, we in Australia send and receive messages throughout the day and night. But it's useful to know how to schedule emails to be sent at times when they have the best chance of being read and responded to. Hammering out a message at 3am may help you get something off your chest, but can also appear strange to the recipient several hours later.

To delay sending an email in Gmail, click the down arrow next to the Send button and select 'Schedule send'. Either choose one of the three suggested times or click 'Select date and time' (see screenshot above) to specify precisely when to send the email, then click 'Schedule send'.

In the Outlook desktop program, click the Options tab then the Delay Delivery button. Tick the 'Do not deliver before' box and select a date and time to send the email. On the Outlook website, click the arrow next to the Send button, choose 'Schedule send' and click 'Customised time' to specify the details.

Thunderbird still doesn't offer an email-scheduling option, but you can get the feature by installing an add-on. Click the three-line menu button, select 'Add-ons and Themes' and search for send later. Click 'Add to Thunderbird' next to the matching add-on and click Add. When you compose a message, click the new Send Later button on the toolbar to schedule a date and time.

MANAGE YOUR FILES LIKE AN EXPERT

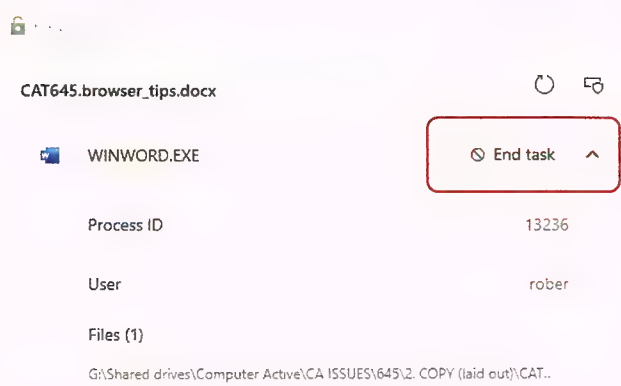
6 Unlock and delete locked files

It's always frustrating when you try to delete, move or rename a file or folder, only to be told that 'access is denied'. The error message may say that the item is in use by another program, or you don't have permission to perform the action, but Windows won't tell you which program or service is locking the file.

Rather than ignore the stubborn item, you can use a new option in Microsoft PowerToys (github.com/microsoft/PowerToys) to determine which background process on your PC is restricting your access, and free the file or folder from its clutches. The feature is called File Locksmith and was introduced in version 0.64 of the free system utility suite, which was released in November.

To use it, first ensure that PowerToys is running in Administrator mode, then click the File Locksmith option and switch on Enable File Locksmith. Right-click the locked file or folder, choose 'What's using this file?' and File Locksmith will reveal the process responsible. Click 'End task' next to it (see screenshot below) to close the program or service, and unlock the item so you can delete, move or rename it.

If File Locksmith can't help, download and run the free tool ThisIsMyFile (www.snipca.com/44584), which unlocks and deletes locked files "with no ifs or buts". Either drag the undeletable file into the program's Files/Folder box or click the Browse button to find and select it. Click 'Unlock' to free the file from the unknown process, then click Delete. For particularly stubborn items, select 'Reboot & Delete' to shut down your system and remove the file on start-up.



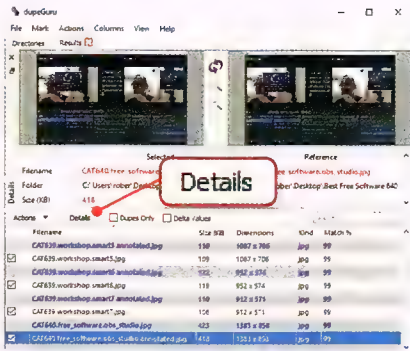
Use File Locksmith to find out which process is locking your files (Word, in this case) and free them.

7 Find and delete duplicate files

One of the most common requests we get from readers is to recommend a way to delete duplicate files – particularly photos. Now that many of us transfer files back and forth between numerous sources – including our phones, online storage and USB sticks – it's easy to accumulate several copies of the same item, but more difficult to locate and remove them all.

To avoid wasting valuable hard-drive space on unwanted duplicates, run regular scans with dupeGuru (dupeguru.voltaicideas.net). This excellent free tool was updated last year to improve its accuracy (previously it was erroneously marking some files as duplicates) and make it easier than ever to find and delete 'dups'.

Click the plus sign in the bottom-left corner of the program window to select the drive or folder(s) you want to scan, then choose an Application Mode – Standard checks for copies of all file types, while the Music and Picture modes focus on audio and image files. Select 'File name' or Contents in the Scan Type menu – or click More



Keep your PC free of duplicate files by running regular scans with dupeGuru.

Options to customise dupeGuru's duplicate detection – then click Scan.

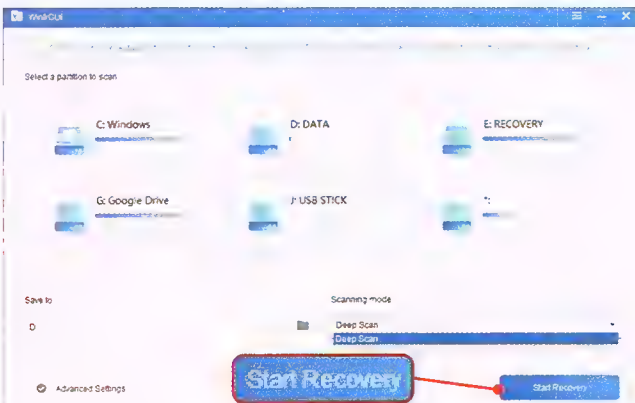
Results appear in a new tab, with the original versions of files highlighted in blue. Tick the boxes next to all the duplicates you want to remove – or press Ctrl-A to select them all – then press Ctrl-D to delete them. Click 'Details' (see screenshot left) to preview images before you bin them, and Dupes Only to show only copies of files, not the originals.

8 Recover accidentally deleted files

When you accidentally delete an important file from your PC, and it's not in the recycle bin, it's worth trying a file-recovery program to rescue the lost item. But many 'free' tools force you to upgrade to their paid-for versions to restore data – essentially charging you to get back your own content. To avoid this frustration and cost, download WinfrGUI (www.winfr.org) to safeguard you against future loss.

Based on Microsoft's command-line tool Windows File Recovery, this app lets you recover unlimited photos, videos, documents and other files for free. Simply select the drive or partition that you want to scan for deleted files – this can be a hard drive, SSD, memory card or USB stick – then choose a folder to restore the files to.

Decide whether to perform a Quick Scan or a more thorough Deep Scan, then click Start Recovery (see screenshot below). WinfrGUI will then find, recover and list deleted files. To save time in future, click Advanced Settings before scanning to specify which file types to look for and which folders to search.



Download WinfrGUI to easily recover important files you've accidentally deleted from any of your drives.

IMPROVE YOUR CONNECTIVITY

9 Diagnose problems with your Wi-Fi

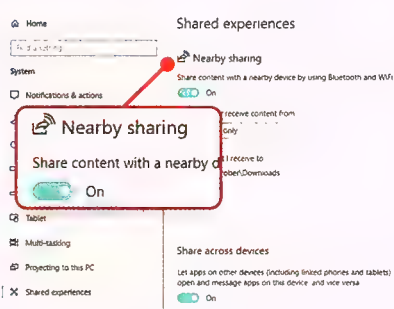
It's easy to take Wi-Fi for granted until it stops working – and then you need to figure out what's gone wrong. Perhaps your PC has disconnected from the wireless access point, your internet signal has mysteriously dropped or a rogue device has connected to your network and is slowing you down. We've previously recommended Wireless Network Watcher from NirSoft (www.snipca.com/42076) as a way to detect the latter problem and the prolific software developer now offers another useful free Wi-Fi tool.

Released last May, WifiDiagnosticsView (www.snipca.com/44593) monitors your Wi-Fi adapter for changes and tells you exactly when they occurred. These include instances when it scans for available networks, connects to and disconnects from an access point, is subject to a change in signal quality and other significant events. When a failure is detected, the tool provides an error code and description, so you can look it up online and diagnose your Wi-Fi problem. It also tells you the SSID of your network, the make of your adapter, whether security is enabled and other useful information.

To keep WifiDiagnosticsView running in the background, click the Options menu and select Put Icon On Tray (see screenshot below). You can then click its system-tray icon to launch the program whenever you need to check your Wi-Fi.

10 Send large files quickly using Bluetooth

Many of us now use Bluetooth devices such as earbuds, hearing aids and fitness trackers, but the technology is also a great way to quickly share files



Switch on 'Nearby sharing' in Windows to transfer large files between devices.

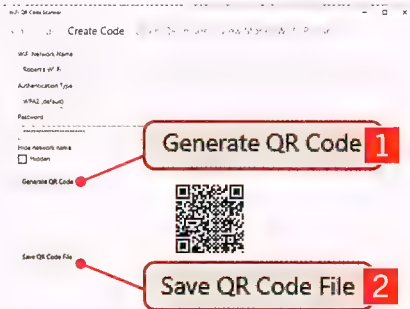
between your PC and phone or another computer.

To do this, you first need to 'pair' the devices – open the Settings app in Windows 10 or 11, choose Devices, then 'Bluetooth & other devices' and ensure Bluetooth is switched on. Click 'Add Bluetooth or other device' ('Add device' in Windows 11), choose Bluetooth and select the device to connect to.

Check that the six-digit PIN matches on both devices then click Connect to pair them.

To share small files, simply click the Bluetooth icon in your system tray (click the small up arrow if you don't see this), choose 'Send a File' and click the device you want to transfer the file to. Browse to the file and click Open then Next to share it – tap or click Accept on the other device to complete the transfer.

A better option, which allows for faster and larger file transfers between Windows and Android devices (iOS devices use AirDrop instead), is to activate 'Nearby sharing' on your PC. Open Settings and click System, then 'Shared experiences' (Windows 10 only) and switch on 'Nearby sharing' (see screenshot above). You can now share a file from Windows by right-clicking



Keep your Wi-Fi password secret by using an app that turns it into a QR code that you share.

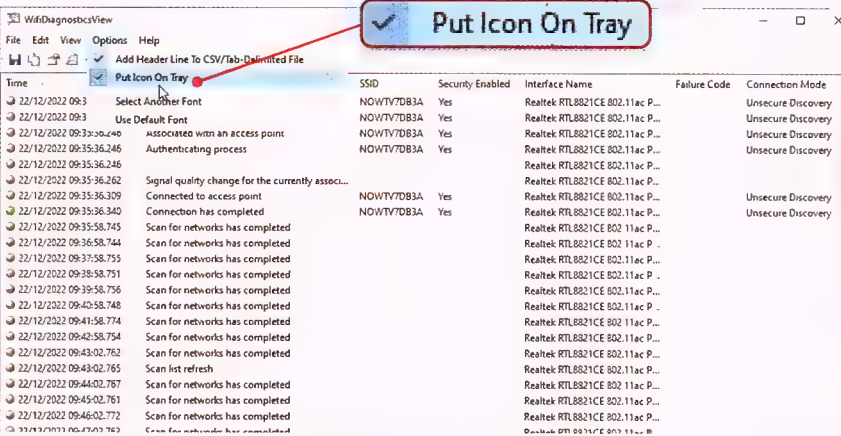
it, choosing 'Bluetooth device' in the 'Send to' menu and selecting the device. On your Android phone or tablet, tap Share in an app and press Nearby Share to scan for and connect to Bluetooth devices.

Note that 'Nearby sharing' only works if your PC's Bluetooth adapter uses at least version 4 of Bluetooth. You can check which version you have by downloading a new program called Bluetooth Version Finder (www.snipca.com/43004), which saves you having to delve into the Windows Device Manager. Click 'More info' then 'Run anyway' if you see a security warning.

11 Share Wi-Fi passwords using QR codes

Android and iOS devices make it easy to connect to Wi-Fi networks by scanning QR codes with their cameras, and also let you generate a code for your own Wi-Fi network that you can share with guests without disclosing your password. Although Windows doesn't offer these useful options, you can add both to your PC by installing the free app WiFi QR Code Scanner from the Microsoft Store (www.snipca.com/44623). This allows you to scan a QR code and instantly connect to a Wi-Fi network by holding the code – whether it's on a phone screen or a physical card – in front of your laptop's camera, with no need to request or type a lengthy password.

To generate a QR code for your own Wi-Fi network, which you can print and stick on the fridge or email to other people, click the Create Code tab at the top of the app window. Enter your network's name and password, and click Generate QR Code (1 in our screenshot above). Test that the new code works by scanning it with your phone's camera. Click 'Save QR Code File' (2) to save the code as an image file that you can print and share as required.



WifiDiagnosticsView monitors your Wi-Fi for changes to help you diagnose problems.

CAPTURE MEDIA CONTENT FROM ANY SOURCE



PicPick lets you record two-minute videos of your screen complete with audio.

12 Record your screen including audio

Knowing how to record videos of what's happening on your screen is a very useful skill to master. Not only does it let you show friends and family how to carry out specific tasks, but it also means you can demonstrate problems you've been experiencing yourself to get the technical support you need. Last year, the brilliant free (for personal use) screen-capture tool PicPick added a Screen Recorder feature that lets you make videos of your desktop with accompanying audio, so you can narrate what you're doing and create your own how-to guides of up to two minutes in length.

To use the new feature, download, install and run PicPick (picpick.app/en) then click Screen Recorder on the program's 'Pick a task' screen or right-click its taskbar icon and choose the option there. PicPick will then open a Recording Area window with a default size of 640x360 pixels – you can move and resize this to cover the area you want to capture. Alternatively, click the Fullscreen Mode button on the floating toolbar to record your whole screen. Click

the Sound button to choose an audio source on your PC, such as your microphone (see screenshot below left), then click the Rec button to start recording – click it again or press F9 to stop.

By default, PicPick saves videos in MP4 format, but you can reduce the file size (and quality) by recording them as GIFs instead, and adjust the video quality in the program's Recording settings. To record videos of longer than two minutes, you need to pay US\$24 a year for the premium version of PicPick.

13 Download streaming audio and video

Most websites now prefer us to stream their content in our browsers rather than download it, which is annoying if you want to save a video or music track to play later. One way around this is to install DownZemAll (www.snipca.com/44635), a fast and free download manager that makes downloading streaming content a doddle.

Simply click the Download Video/Audio Stream button on the program's toolbar and copy and paste the web address of the stream – such as a YouTube or SoundCloud URL – into the Download box, then click Continue. Alternatively, wait for DownZemAll to detect the media content automatically. Select the format and resolution you want to save the file in, then click Start (see screenshot below) to download it to your PC.

You can also download other types of files, including images, PDFs, documents and ZIP archives by clicking the blue plus sign on the toolbar and pasting the file's URL. Click the Download Web Page

Content button to detect and download every file on the specified page.

Additionally, there's a Down Right Now extension for Chromium browsers (www.snipca.com/44629) and Firefox (www.snipca.com/44630), which lets you download files in DownZemAll by clicking its toolbar button then choosing Download or by right-clicking a download link then selecting 'Save link'.

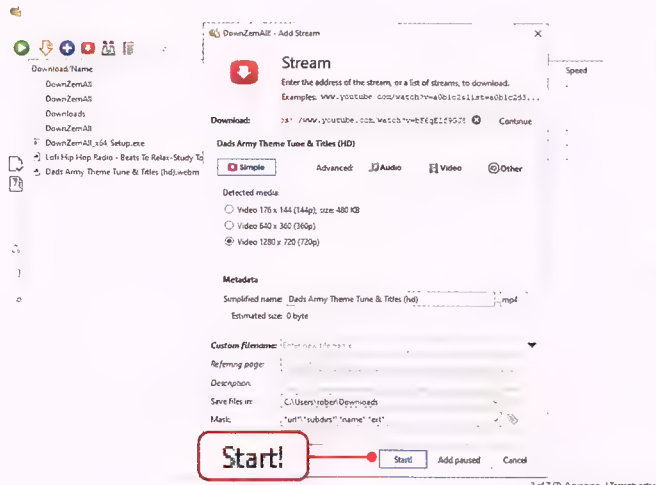
Note that DownZemAll may trigger a Microsoft Defender SmartScreen warning, but it's safe to use so just click 'More info' then 'Run anyway'.

14 Copy text from photos and videos

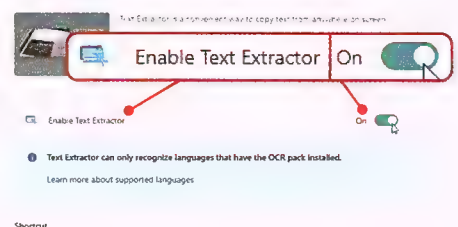
Optical character recognition (OCR) is traditionally used to convert scanned documents into editable text, but it can also now extract text from images you capture, receive via email and view in your browser. Last October, Microsoft added an OCR tool to its PowerToys suite (github.com/microsoft/PowerToys), which can copy text from anywhere on your screen – including within images and videos – so you can paste it elsewhere.

To activate this new feature, open the PowerToys Settings screen, click Text Extractor and switch on Enable Text Extractor (see screenshot below). Press Windows key-Shift-T and your screen will turn grey. Drag your cursor over the image or paused video you want to extract text from, then release your mouse button to save the selected area to your clipboard. Open the program you want to use the copied text in, such as Microsoft Word or an email client, and either press Ctrl-V or right-click and choose Paste to insert it into a document or message. Text Extractor couldn't be easier to use and its OCR is pretty accurate, but it's worth double-checking the result.

Use DownZemAll to download streaming content that you can play whenever you want.



Text Extractor



The new Text Extractor tool in PowerToys copies text from images and videos.

TAKE CONTROL OF YOUR SOFTWARE

15 Install software more easily – without junk

Knowing how to install software is a rudimentary PC skill that usually involves little more than double-clicking an EXE file and following the on-screen instructions. However, if you want to install multiple programs without having to visit individual download sites and decline unwanted junk during installation, the expert solution is to use a ‘package manager’. The built-in Windows Package Manager – called Winget for short – relies on you typing complex commands into Command Prompt, but you can make things considerably easier by using WingetUI ([github.com/](https://github.com/marticliment/WingetUI)

[marticliment/WingetUI](https://github.com/marticliment/WingetUI)).

This new free tool lets you search Winget’s database, and that of another package manager called Scoop, via a simple interface that doesn’t require you to learn commands. Click WingetUI’s Discover Packages tab (1 in our screenshot below) to browse more than 4,000 packages (junk-free downloads) of popular free programs. Double-click or right-click an entry and choose Install (2 to download and install the software.

The Software Updates tab (3 tells you which installed tools have newer versions available and lets you update them all in one go, while the Installed Packages tab (4 lets you remove unwanted

programs in a couple of clicks.

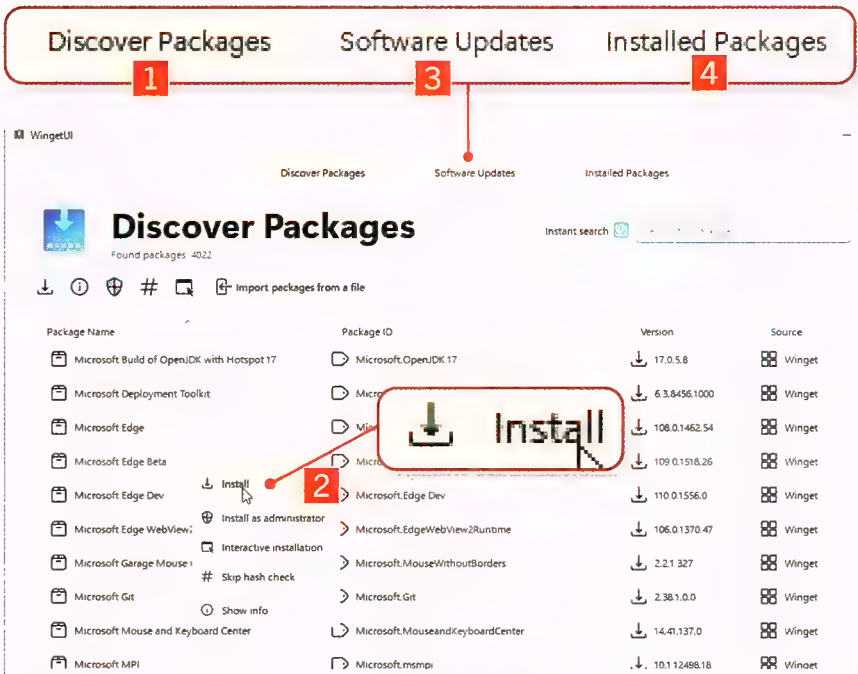
WingetUI triggers a Microsoft SmartScreen warning, but it’s safe to use so click ‘More info’ then ‘Run anyway’.

16 Stop programs slowing your PC booting

An increasing number of programs and apps now set themselves to start automatically when Windows launches. You may not even realise these tools are running, but they slow your PC by consuming valuable memory and processing power that would be better allocated to more important tasks. Although you can use the Startup tab in the Windows Task Manager to disable unnecessary startup items, it’s equally useful to delay programs so they don’t all run at once and compete for system resources.

The excellent free tool HiBit Startup Manager (www.snipca.com/44640) gives you full control over your startup items, allowing you to significantly boost the performance of your PC. It shows you the programs that have the highest impact on your system’s startup speed, and lets you disable, delete or delay them by right-clicking and choosing the most suitable option (see screenshot below).

Should you choose to delay rather than disable a ‘high impact’ but essential startup item, you can specify how long to wait after Windows starts before it runs. Alternatively, choose Automatic Delay to set the program to run when a certain percentage of your processor or hard drive is idle. Delayed items are listed at the bottom of HiBit Startup Manager’s main window, where you can right-click them to edit or remove the delay. ■



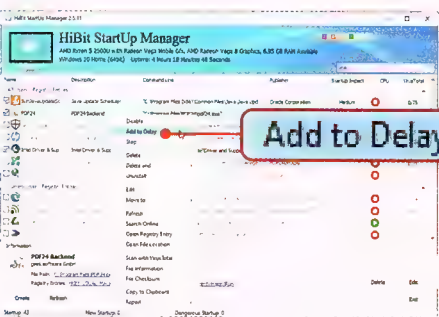
Install and update thousands of free programs in one place using WingetUI.

CONTROL WHICH UPDATES WINDOWS INSTALLS

All the tasks in this feature rely on Windows running smoothly, but Microsoft’s ‘Feature updates’ can interfere with this, and cause more problems than they fix. Although you can delay or disable these updates by tweaking the registry or the Group Policy Editor (in Windows 10 or 11 Pro), it’s much easier to use a new free tool called InControl (www.grc.com/incontrol.htm). This keeps your version of Windows at the current release and blocks Feature updates until you’re ready to install them, while still allowing

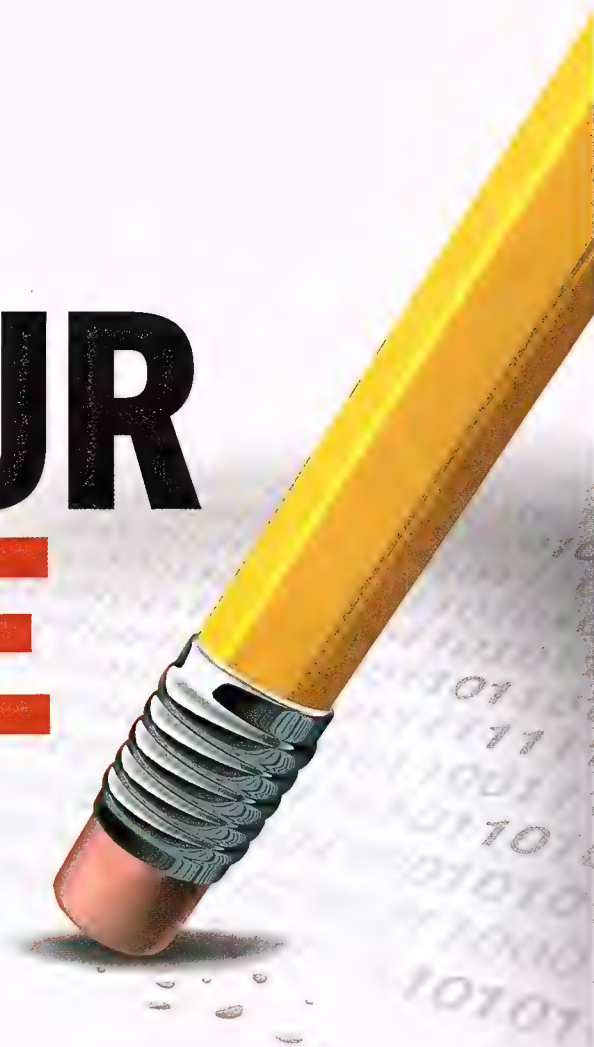
essential security updates.

Download and run the program, and you’ll see a message in red saying ‘OS upgrades are not under your control on this system’. Click the Take Control button and this will change to a green message confirming that ‘You are in control of OS upgrades’, and no system updates will be installed until you click Release Control. You can tell InControl which version of Windows you want to upgrade to – when it becomes available – by changing the numbers in the bottom-left corner.



HiBit Startup Manager lets you delay startup items that are slowing your PC.

ERASE ALL YOUR PRIVATE DATA



It's vital to remove personal data from your PC to stop other people seeing it. **Robert Irvine** explains how to remove every trace of your activities using two powerful free tools.

WHAT YOU CAN DO

- Wipe details of recently opened files and programs
- Overwrite deleted data to make it impossible for others to recover
- Remove leftover traces from the Windows registry
- Delete unwanted tracking cookies while retaining essential ones
- Erase your browsing history from all your browsers
- Delete stored passwords and info you type into online forms
- Shred files and folders containing sensitive data

Anyone who wants to know what you've been doing on your computer – both online and offline – can find out in just a matter of seconds. Your PC stores details of all your Windows and web activities, including the files you open, the sites you visit and the software you use, and makes this information easy for you to access. But this also makes it easy for others to access, which significantly compromises your privacy, even if you have nothing to hide.

Manually deleting personal data from all the programs you use can be time-consuming and confusing, and traces of your activities are inevitably left behind, allowing savvy snoopers to see what you've been up to. To completely erase all these elements so

they can't be recovered, you need a dedicated privacy cleaner. Thankfully there are two excellent free tools available.

Privacy Eraser (www.cybertronsoft.com/products/privacy-eraser) and PrivaZer (privazer.com) will both purge your PC of all private data and leftover traces, including temporary files, tracking cookies and usage logs.

In this feature, we reveal the options you must use in both programs to perform the most thorough clean-up possible and hide all details of your activities from prying eyes. We explain which boxes you must tick, where to find them and how to ensure you don't erase more – or less – data than you intend.

ERASE WHAT YOU DO IN WINDOWS

Recently opened files and programs

The logical place to start when removing details of your Windows activities is the Start menu, which shows anyone who uses your PC the programs you've recently added and those you use most often. Windows 11's Start menu also lists Recommended items including recently opened files.

Further information about what you've been doing is revealed by the Jump Lists that open when you right-click the taskbar or Start-menu icons for programs and File Explorer. These list files, folders and links you opened recently or use frequently, so you can access them again quickly, but they also compromise your privacy by letting other people access those items, too.

In Privacy Eraser, you can wipe this data in the Windows Explorer section of the Windows tab (see screenshot above right). Select the options Start Menu Recent Items and Taskbar Jump Lists before you run a clean-up with the program. It's also worth ticking the boxes for the following: Windows Search History – to stop anyone seeing which items you've searched your PC for; Start Menu Run History – if you've used the Run tool in Windows to



Delete recently used histories to stop people seeing which files you've opened.

access private files and folders; and 'Open & Save Dialog History' – to delete the file history from the Open and Save dialogue boxes.

PrivaZer also lets you delete details of recently opened files and programs. Click 'Scan specific traces' on the home screen, choose 'Software use' and select 'Start JumpLists, Quick Access'. Tick the box next to 'Start menu' to wipe usage data from the menu and the taskbar, then choose the Jump Lists you want to delete – such as for Windows Explorer (File Explorer), specific programs or all Jump Lists on your computer. Select 'Windows history' to remove details of your recent searches, Run history and the files and directories (folders) you've used.

HOW TO USE PRIVACY ERASER AND PRIVAZER

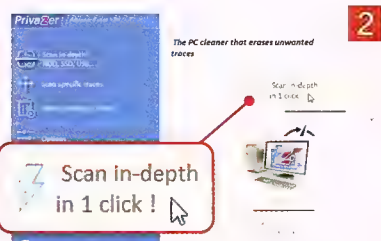
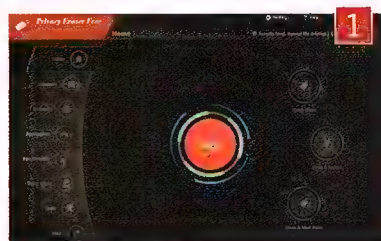
Privacy Eraser and PrivaZer have very different interfaces, but work in a similar way. You can perform an initial scan from both home screens using their default settings – just click the big red Scan button in the former (see screenshot 1) and 'Scan in-depth in 1 click' in the latter 2. Once the scan is complete, click either Quick Clean or Clean to remove all privacy traces, junk files and other unnecessary elements in one fell swoop.

The drawbacks to this method are that full scans and clean-ups take a long time and may remove more or less data than you intended. This makes it useful to know which boxes to tick/untick among the privacy options offered by both tools.

Privacy Eraser is the friendlier of the

two programs, sensibly organising its options into tabs such as Windows, Browsers and Applications. PrivaZer offers more deep-cleaning features, but it's not always obvious where to find them because they're located in sections such as 'Scan specific traces'. However, it does let you click Options to specify whether you're a Basic or Advanced user and tailor its settings to your needs.

Both tools are free to use, though Privacy Eraser restricts a few options to its paid-for version, which costs US\$19.95 a year. Other than targeting the same areas of your PC, the two programs don't clash so you can either switch between them as required or choose the one that works best for you.



Hidden data stored in Windows

One of Privacy Eraser's greatest strengths is that it wipes personal data from Windows you may have forgotten about but that can still be accessed by other people. For example, you may have copied sensitive information to the Clipboard that anyone can then paste elsewhere by pressing Ctrl-V. If they're particularly nosy, they can press Windows key-V to open your Clipboard history and see the last 25 items you've copied. To stop this happening, select Clipboard in the Windows System section of the Windows tab to erase your Clipboard history.

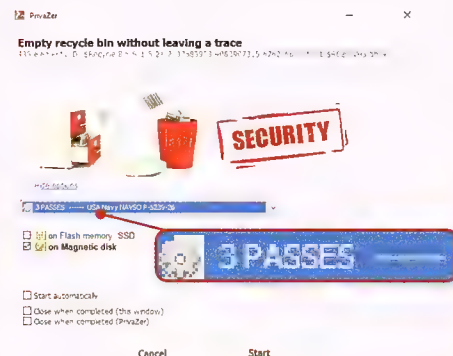
It's equally easy to forget that files and folders you delete are usually sent to the recycle bin rather than removed from your PC. Ticking the Recycle Bin option in Privacy Eraser empties the bins on all the drives connected to your computer, so their contents can't be retrieved.

PrivaZer goes even further by thoroughly overwriting files deleted from the recycle bin to guarantee 'permanent deletion without any possibility of recovery'. Click 'Delete without a trace' on its home screen, select 'Empty recycle bin (without a trace)' then select 'See advanced options'. Click the dropdown menu to specify how many times to overwrite recycle bin data – PrivaZer suggests three 'passes' are enough to make recovery impossible (see screenshot below) – then click Start.

You can set the program to always empty your recycle bin after a clean-up by choosing Options on the home screen and clicking Next until you reach the 'Yes, at each cleanup of my PC with PrivaZer' option under 'Empty recycle bin'.

Traces of data in free drive space

When you delete a file from your PC, all that's actually removed is the reference to that item in the Windows



PrivaZer empties your recycle bin and overwrites files so they can't be recovered.



master file table (MFT). The file itself remains on your hard drive until it's overwritten with new data, though the space it occupies is now marked as 'free' by Windows. This is useful if you need to 'undelete' the file using a specialist recovery tool such as Recuva or WinfrGUI, but it also means that your hard drive contains lots of invisible data that potentially compromises your privacy.

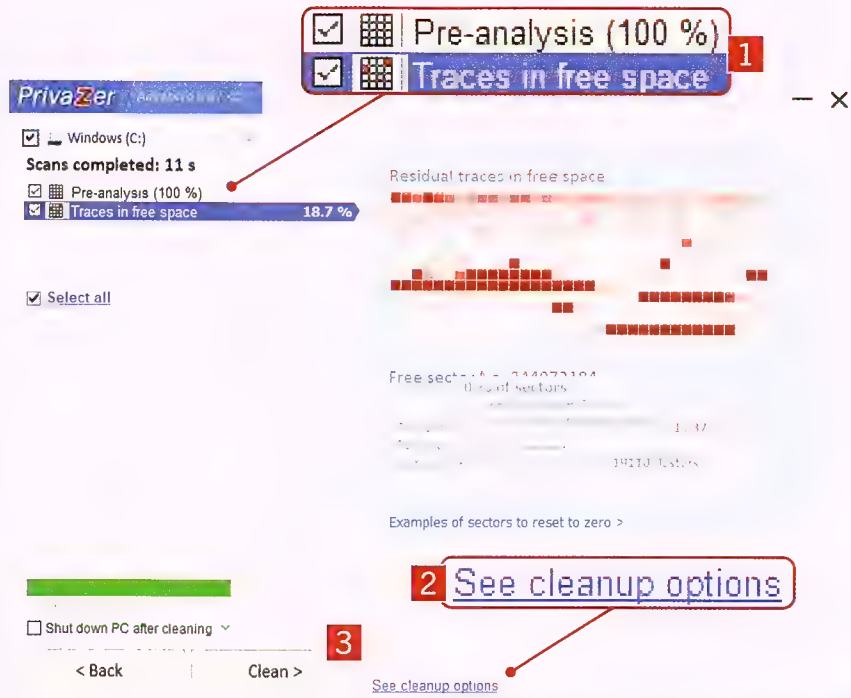
PrivaZer helpfully provides a dedicated option for removing junk traces from 'free' disk space. On its home screen choose 'Scan specific traces', select 'Residual traces of old files' under 'Which traces', then select 'Residual traces of old files' on the following screen. Tick the boxes for Pre-analysis and 'Traces in free space' (1 in our screenshot above right), then click the Scan button.

PrivaZer will identify sectors of your hard drive that contain traces of old files and need to be 'reset to zero'. Click 'See cleanup options' (2 to specify how many times to overwrite the free space – again, three 'passes' is enough – then click the 'Free space' tab and choose 'Smart cleanup' – this is much faster than 'Normal cleanup' because it only cleans necessary sectors. Go back to the previous screen and click Clean (3) to completely erase all the invisible data from your PC.

Broken shortcuts to deleted files

Shortcuts that no longer work because the files, folders or programs they point to have been deleted are usually more of an annoyance than a privacy concern. But the shortcuts' file names may be enough for nosy parkers to deduce the contents of the original items and wonder why they were removed, so it's wise not to leave them behind.

Privacy Eraser makes detecting and deleting broken shortcuts very straightforward – simply go to the



Use PrivaZer to thoroughly delete all traces of data from 'free' space on your PC.

Windows System section and tick the boxes for Invalid Start Menu Shortcuts and Invalid Desktop Shortcuts before running a scan (see screenshot right).

In PrivaZer, select Options on the home screen, click Next twice and choose either 'Yes, remove invalid shortcuts' or 'Yes, invalid shortcuts + list of most used' to also delete details of frequently used programs.

Leftover traces in the registry

Every time you uninstall a program or change something in Windows, redundant settings get left behind in the registry. Over time, these leftovers build up and slow your PC, and removing them can both speed it up and protect your privacy from anyone hunting for leftover traces.

Deleting registry files yourself can be risky, but Privacy Eraser's Windows tab makes the job easier by

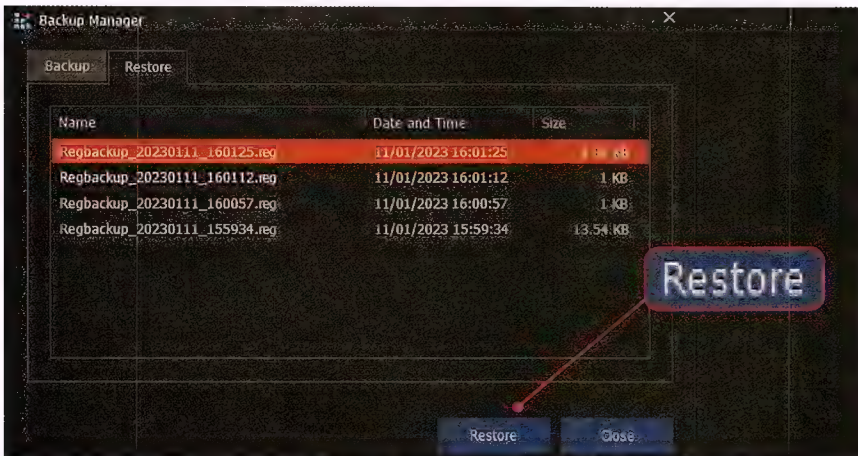


Delete invalid shortcuts to avoid revealing details of removed files.

letting you select items that it's safe to remove. Options include Obsolete Software, which wipes registry entries for programs you've uninstalled; and Shared DLLs, which deletes old entries for dynamic link libraries that no longer exist.

Privacy Eraser automatically backs up your registry before making any changes, and lets you restore it by clicking the three-dot icon next to the Registry heading, then the Restore tab. Select a registry backup and click Restore (see screenshot left).

To clean the registry in PrivaZer, click 'Scan specific traces', choose In Registry and select Registry on the left. Click 'Save registry' in the bottom-right corner to create a backup before scanning for and cleaning leftover traces – you can safely leave the pre-ticked options as they are.



Privacy Eraser backs up your registry automatically before making any changes.

ERASE WHAT YOU DO ON THE WEB

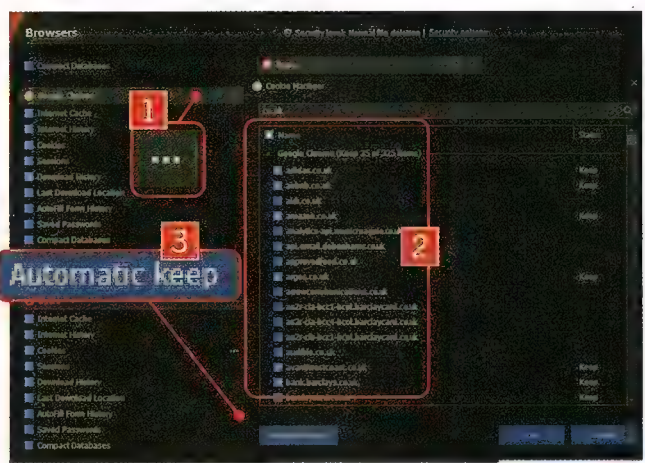
Tracking cookies from your browsers

All the main web browsers now offer protection against website cookies by allowing you to either block them all (which can stop some sites working properly) or block only the tracking variety from third-party sources. But removing cookies that have already been planted on your PC, or have slipped through your browser's net, is less easy to do, particularly if you want to keep 'good' cookies that sign you into websites but delete 'bad' ones that follow you around the internet. If you use several browsers, this task becomes even more difficult.

Fortunately, help is at hand from Privacy Eraser, which simplifies the process of wiping unwanted cookies while keeping useful ones. Click the Browsers tab to see options for all the browsers installed on your computer – or at least the most popular ones, including Chrome, Edge, Firefox, Brave, Opera and Vivaldi.

The Cookies box for each of these should already be ticked, and when you click the three-dot button next to it (1 in our screenshot above right), the Cookie Manager will show you a list of all the cookies installed in that browser (2. Select all those you want to keep to stop the related websites logging you out, then click OK to confirm. If you're unsure, click the 'Automatic keep' button 3 to let Privacy Eraser decide for you, though it mainly chooses cookies for webmail services.

PrivaZer's cookie-cleaning works in a different way by listing them all in one place, rather than organising them by browser. This makes it easier to decide which cookies to retain and which to remove, especially when they appear in several browsers. To access this option, click 'Scan specific traces' on the home screen and choose 'Internet activities'. Select 'Cookies, Super/ Evercookies' under 'Select scans'



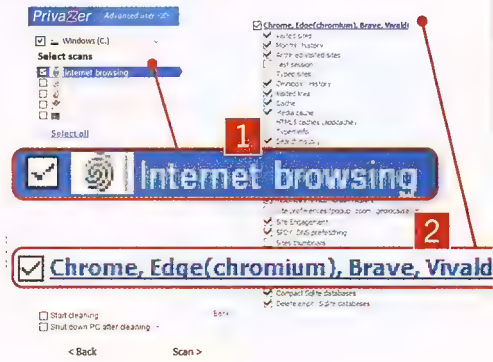
Left: Privacy Eraser lets you decide which browser cookies you want to keep and which to delete. Below: Carry out precise cleaning of your browsing data by selecting specific options in PrivaZer.

(super cookies let websites identify your browser and are harder to remove than standard ones), then click 'See cookies'. In the Cookies box that opens, choose Manual to select which cookies to keep and remove – those in the 'To delete' list on the right (see screenshot below left) are most likely to be tracking cookies. Click the 'Show all' dropdown menu to filter cookies by type and browser, or select Smart to save cookies related to specific companies. Once you've made your selection, go back to the previous screen and click Scan then Clean to remove unwanted cookies.

Browsing history and internet cache

Anyone who wants to know which websites you've visited and when can instantly find out by pressing Ctr-H to view your browser's History. It's the biggest potential privacy leak on any PC, but few of us bother to regularly clear our histories to cover our online tracks. Websites stored in your History auto-complete when you start typing their URLs into your browser's address bar, which makes them quicker to revisit but also reveals details of your web activities.

As you'd expect, Privacy Eraser's Browsers tab includes the option to delete your Internet History from all the browsers you have installed. You should also tick the boxes to wipe the following: Internet Cache – the temporary internet files folder that contains copies of images, videos and other content from pages you've visited; Sessions, which keeps logs of the sites you've visited; and Download History, which stores details of files you've downloaded from the web. Note that deleting the latter only removes the list of downloads from your browser, not the files themselves.

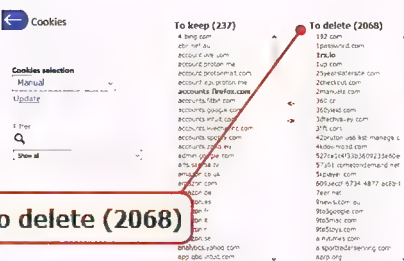


PrivaZer adopts a similar approach to deleting your browsing history and other details of your internet activities, but is able to perform a deeper and more precise clean. Click 'Scan specific traces' then 'Internet activities' and select 'Internet browsing' (1 in our screenshot above).

Click the relevant link for your browser, such as 'Firefox, Pale Moon, LibreWolf' or 'Chrome, Edge (Chromium), Brave, Vivaldi' 2 to choose from a long list of data-deletion options. These include 'Visited sites', 'Typed sites' (URLs you manually entered into the address bar), 'Visited links' (those you clicked on web pages), 'Media cache' (including images and videos), and 'Downloads history'.

We particularly like that you can remove saved search queries from your browser, both from its search box/address bar and from the websites for Google, Bing and Yahoo. You're likely to be surprised by the number of internet traces PrivaZer finds when you click Scan – nearly 77,000 on our PC – but these can all be deleted with a single click.

Stored passwords and form data Storing passwords and other personal information in your browser,



PrivaZer suggests which cookies to delete – these are mostly tracking cookies

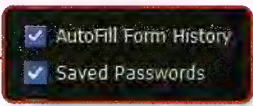


including your address, phone number and payment-card details, saves you a lot of time when signing into websites and filling in online forms. But though it's convenient to auto-fill these details, the fact they aren't encrypted makes them available to anyone with access to your device or user profile.

Manually removing this data from all your browsers will boost your privacy and security, but it's also a bit of a hassle, which is where Privacy Eraser comes in handy. Simply tick the boxes AutoFill Form History and Saved Passwords (see screenshot) for each of your browsers to delete the information in your next clean-up. This will prevent the data from auto-filling but also stop it being stolen and reused. Click 'Yes' if the program warns you that all your saved passwords will be cleared.



Privacy Eraser can delete form history and saved passwords from your browser.



In PrivaZer, you'll find the option to delete 'Saved passwords' in the 'Internet browsing' section (see previous tip) – select 'Typed info' to remove other auto-fill data. Alternatively, click the Options button on the home screen and keep clicking

Next until you reach the 'Internet browsers – Autocomplete histories' screen.

In the 'Remove autocomplete histories' section, choose 'Yes (recommended for privacy)' to delete saved form data.

ERASE WHAT YOU DO WITH YOUR SOFTWARE

Traces of your software usage

Browsers aren't the only programs to keep track of your recent activities. Other software stores details of the documents, images, videos and other files that you've opened, edited, played and saved. This information can be easily viewed by anyone else who uses your computer. For this reason, it's a good idea to regularly wipe personal data from the tools most likely to compromise your privacy.

Privacy Eraser provides plug-ins for more than 200 popular programs that remove all traces of your usage by performing clean-ups without changing other settings. Click the Applications tab to view available plug-ins for programs and Microsoft Store apps installed on your PC. Our list included 7-Zip, Microsoft Office, Paint, NET, TeamViewer and Windows Defender, but yours will vary.

Select a plug-in, right-click it and choose Quick Clean, and Privacy Eraser will run a set of cleaning tasks for that program. These target files, folders and registry keys that reveal details of what you've been doing. You can also click the Custom tab to create your own plug-ins, though this requires you to know the exact items you want to clean. You should always close the relevant program before running its plug-in or the data may not be properly removed.

In PrivaZer, you can access the same software-cleaning feature by choosing 'Scan specific traces' then 'Software

use'. Programs are organised into categories such as Downloaders, 'Video, music software' and 'Other software' (1 in our screenshot right) – PrivaZer will automatically detect which tools you have installed.

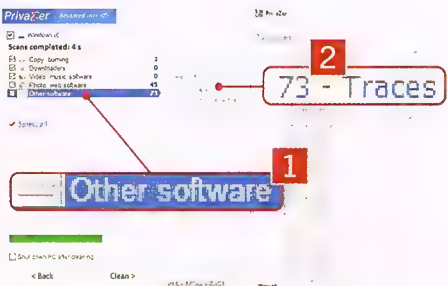
On our PC, it recognised more software than Privacy Eraser managed, including IrfanView, Thunderbird and VLC. Click the Traces link (2) after running a scan to see details of the files, folders and registry keys that will be cleaned.

Unwanted software – in one click

One feature offered by Privacy Eraser but not by PrivaZer is an uninstaller, which lets you go further than just wiping details of your software activities by removing programs completely. Although you can do this using Windows' uninstaller or a third-party tool such as BC Uninstaller (www.bcuninstaller.com), it's a useful additional option for purging your PC of unwanted junk – and stops people knowing you've used a certain program.

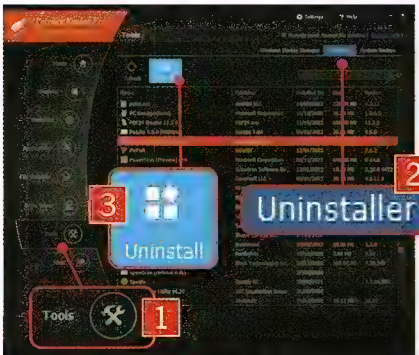
To access the uninstaller, click the Tools tab (1 in our screenshot right) on Privacy Eraser's home screen and select Uninstaller in the top-right corner (2). This will display an alphabetical list of all the programs you have installed – you can reorder these by install date or size by clicking the appropriate column heading, or search for a specific tool.

Select a program you want to remove



PrivaZer tells you which traces it will clean to remove details of software usage.

from your computer and click the Uninstall button (3) to open either the software's own uninstaller or the Windows tool. Once you've got rid of the unwanted software, it's worth scanning for and wiping leftover traces using the advice we provide on page 77.



Privacy Eraser's Uninstaller makes it easy to remove all unwanted software.

SECURELY ERASE FILES AND DRIVES

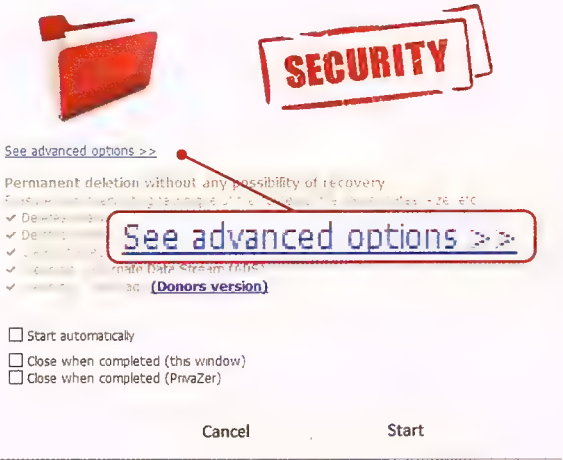
Private files and folders

As well as performing system-wide clean-ups of leftover traces, Privacy Eraser and PrivaZer can also securely delete specific items. This is useful for erasing confidential documents, personal photos and private videos from your PC, to ensure they can't be recovered. As we mentioned earlier, when a file is deleted in the usual way, its contents remain available until its data is overwritten, along with details of its name, modification date and location. Only thoroughly 'shredding' the sensitive item will prevent this data from falling into the wrong hands.

To securely erase files and folders in Privacy Eraser, click the File Shredder tab on the home screen. Click 'Add files' or 'Add folders' to select the items you want to delete – you can add several of each to the queue – then click Start to 'shred' them. The catch is that the free version of Privacy Eraser only overwrites data once – when you click 'Security options' to increase the number of passes, you'll be prompted to upgrade to the Professional Edition. Extra security options including 'Scramble file/folder name' and 'Reset file size to zero' also require a paid-for licence, which is annoying but one of the few restrictions in an otherwise excellent free program.

In PrivaZer, you can shred files and folders without limitations by clicking 'Delete without a trace' on the home screen, then either 'Sensitive files' or 'Sensitive directories'. Select the item you want to delete – press Ctrl-A to choose more than one – then click

Delete without leaving a trace
1 element (Screenshot_20221201-143320.jpg)



either Open (for files) or Select (for folders).

When PrivaZer's 'Delete without leaving a trace' window opens, click 'See advanced options' (see screenshot above) to choose how many passes it should perform when overwriting data. These go up to 35, but – as mentioned earlier – three passes is sufficient to make data impossible to recover. Click 'Start' and PrivaZer will thoroughly shred the item, including all references to it in the MFT and leftover traces in free drive space.

Entire hard drives and USB sticks

If you plan to sell or recycle your PC, it's essential to completely wipe its contents to remove every trace of personal data and ensure it can't be recovered. This is also important if you have sensitive information stored on removable media such as a USB stick. Privacy Eraser includes a Drive Wiper for this purpose, but it's

PrivaZer shreds sensitive files and folders to make them impossible to recover.

restricted to the paid-for version – although you can choose the option, the button to start wiping is greyed out in the free edition.

PrivaZer won't erase everything on a drive, such as programs, documents and photos, but it will remove all leftover traces of your files and activities once you've formatted the drive yourself. Or you can use it to clean elements that compromise your privacy on devices you share with other people.

Click 'Scan in-depth' on PrivaZer's home screen and select the drive you want to wipe – this can be your main hard drive, an external SSD, a USB stick, an SD card, a NAS drive and even an MP3 player. The cleaning options available under 'Select scans' will depend on the device, but for a comprehensive scrub just choose 'Select all'. Click 'Scan' to analyse the drive for traces, then click 'See cleanup options'.

Select 'Secure deletion' in the dropdown menu (see screenshot below) and specify the number of passes to perform when overwriting data. Click the 'Free space' tab and choose 'Normal cleanup' to ensure every 'free' sector of the drive is wiped, then go back to the Scan screen and click Clean. PrivaZer will then securely erase your drive of all privacy traces – this may take a long time depending on the size and contents of the drive. You can click Pause or Stop at any time, and click Modify to lower the priority of the cleaning process so it uses fewer system resources and doesn't slow your PC.

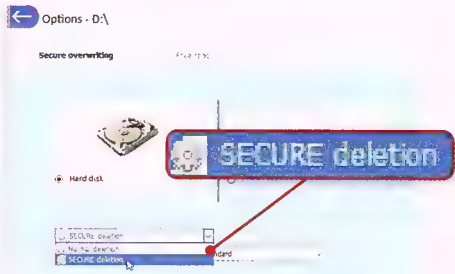
SHOULD YOU PAY FOR PRIVACY CLEANERS?

Unlike many free privacy tools, Privacy Eraser and PrivaZer don't nag you to upgrade to their paid-for editions, though there are some benefits to doing so. As mentioned above, buying a licence for Privacy Eraser – for US\$19.95 a year – unlocks its Drive Wiper and the full set of security options for deleting files. You also get free '24/7' technical support and automatic updates when new versions of the program are released.

The only notable features missing from the free version of PrivaZer are the

cleaning of Shellbags – registry files containing data about the size, position and icons of folders – and automatic clean-ups of data. Upgrading to the Donors version for the amount of your choice – from \$10 upwards – will unlock these options along with automatic updates and the ability to scan and clean from the command line.

However, in both cases, the free versions of the programs will be more than sufficient to erase personal data from your PC.



PrivaZer can securely erase all privacy traces from a hard drive, SSD or USB stick.



REMOVE EVEN MORE JUNK FROM YOUR PC

Schedule clean-ups for convenient times

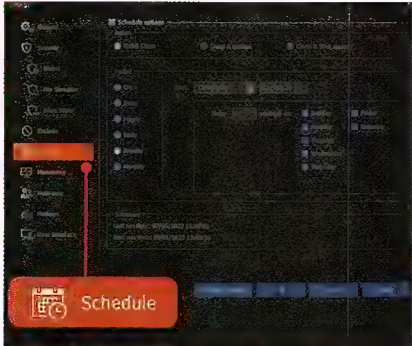
Both Privacy Eraser and PrivaZer let you schedule clean-ups – using settings you specify – to take place at a frequency and time that’s convenient for you, such as when you’re not using your PC.

In Privacy Eraser, click the Settings button in the top-right corner, choose Schedule (see screenshot right) and tick the ‘Schedule options’ box. Select how frequently you want Privacy Eraser to delete private data from your PC – weekly or monthly should suffice – then specify when to perform the clean-up and click Apply.

In PrivaZer, click Scheduled on the home screen then use the dropdown menus to specify the frequency, day and time of the clean-up. Select which drive(s) to clean, click Setup to choose the private data you want to wipe, then click OK to confirm. You can create several scheduled tasks to perform different clean-ups for drives at specific times.

Shut down your PC after cleaning

Full clean-ups in both programs sometimes take longer than an hour, which means you need to wait around to turn off your PC afterwards. To save yourself time and electricity, you can have either tool

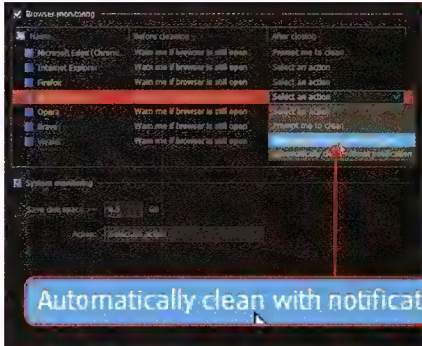


Privacy Eraser lets you schedule clean-ups for a day and time that suit you.

shut down your system automatically once it’s finished cleaning.

To do this in Privacy Eraser, either click the down arrow next to Quick Clean after performing a scan and choose ‘Clean & Shut down’, or click that button on its home screen. You can also click ‘Clean & Restart’ to delete files that require you to reboot your PC to fully remove them.

In PrivaZer, click ‘Shut down PC after cleaning’ (see screenshot below left) in the bottom-left corner of a Scan screen to select that option in the menu that opens. Additional options include ‘Restart PC after cleaning’, ‘PC in sleep mode after cleaning’ and – new in the latest version – ‘Play a song when completed’.



You can set Privacy Eraser to clean all your browsing data automatically.

Perform automatic data clean-ups

To ensure that private data never remains on your PC for longer than it needs to do, you can set your privacy cleaner to delete it automatically. As mentioned opposite, PrivaZer only offers this option in its paid-for Donors version, but Privacy Eraser provides it for free.

Click ‘Monitoring’ in the program’s Settings and select System Monitoring. Tick the ‘Browser monitoring’ box to erase details of your internet activities each time you close your browser. Select the browser you want to clean and choose an action from the dropdown menu, such as ‘Automatically clean with notification’ (see screenshot above). Tick the ‘System monitoring’ box to clean your PC using your default settings when private data is consuming a specific amount of disk space.

Add cleaning options to your right-click menu

Rather than open Privacy Eraser or PrivaZer every time you want to erase private data from a drive or folder, you can add their cleaning options to your right-click menu. Open the Settings page in the first tool and click General, then tick the box ‘Add “Secure Erase with Privacy Eraser” option to Windows Explorer context menu’. You can also add the option to the right-click menu for your recycle bin.

In PrivaZer, choose ‘Advanced options’ on the home screen and click the General tab. In the ‘Installation of contextual menus’ section, select ‘For drives, storages’, ‘For files’ and ‘For directories’ to add a ‘Delete without a trace’ option to the right-click menus of drives, files and folders. You can also add an ‘Empty without a trace’ option to your recycle bin’s right-click menu. ■

Shut down PC after cleaning

- Shut down PC after cleaning
- Restart PC after cleaning
- Close session after cleaning
- Close when completed (PrivaZer)
- PC in sleep mode after cleaning
- PC in hibernation mode after cleaning
- Play a song when completed
- Minimize PrivaZer after cleaning

☐ Star

☒ Shut down

< Back

Scan >

Set PrivaZer to shut down your PC automatically once it’s finished cleaning.

System News

Mark Williams is ready to get HAMRed on cheap high-capacity drives.



Mark Williams
Mark is an IT professional with a strong interest in voiding warranties.

Hard drives, once the mainstay of client computer mass storage, is now relegated to the backseat in current day PCs – if they're included in the system at all.

Solid state drives have surpassed the price and capacity hurdles which, over a decade ago, merely made them a novelty when hard drives were still ruling the capacity roost. It's at a point now where the market has completely flipped, and most consumer PCs now only have a single SSD for mass storage. Cheaper systems can still have HDDs due to their continued price/capacity competitiveness, but they're becoming few and far between now.

With SSDs all but king in PCs, how is it that the likes of Seagate, Toshiba and Western Digital are still selling tens of millions of HDDs a year? In a word, the cloud.

While traditional on-site storage for businesses is still common, more and more businesses are migrating their data into the cloud for their

"Solid state drives have surpassed the price and capacity hurdles which, over a decade ago, merely made them a novelty when hard drives were still ruling the capacity roost."

SHOP TALK

How popular are HDDs in your desktop builds? Will 30TB+ capacities keep them relevant for desktop PCs?

Jaimie, Leader Computers:

"We are installing spinning disks in less than 10 percent of system builds these days. Streaming services and online services have largely killed the need for mass storage for the average home user, with secondary drives primarily being for family photo backup or content creators dealing with large amounts of video footage. That being said, we sell a huge number of large storage drives for NAS devices, and businesses all need multiple ways to back up

their data including NAS both on and off-site, SAN and Datacentre."

Richard, Aftershock PC:

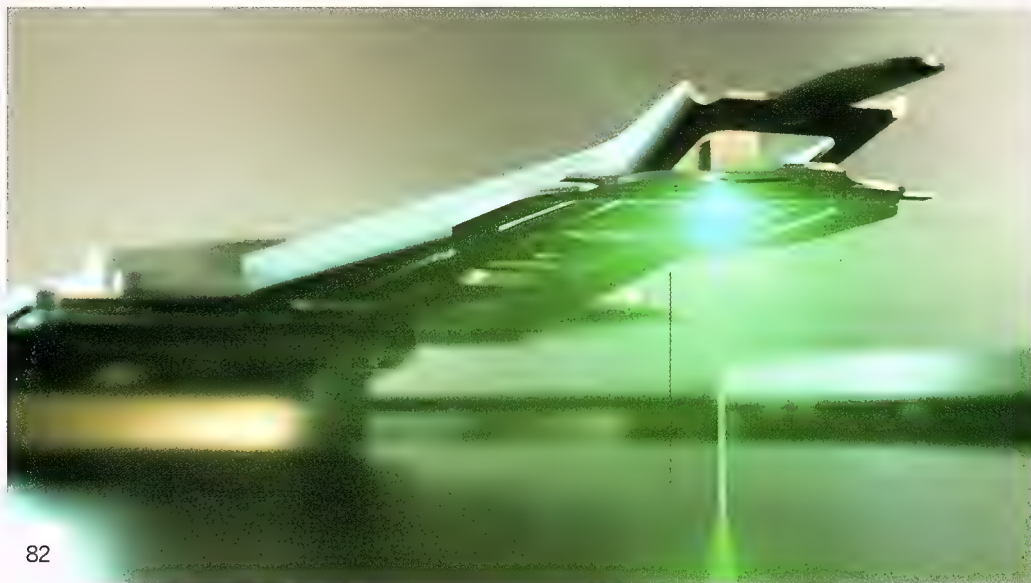
"We started dropping HDDs as a default from our builds last year as SSD prices became much more reasonable for a decent size. We still give the option for customers to add them in and probably 40 percent still do, but that percentage is dropping quickly as the price of SSDs continues to drop."

computing and storage needs, concentrating storage in data centres dotted around the globe and run by the likes of Amazon, Google, Microsoft, Backblaze and many others. The COVID19 lockdowns of the past couple years really accelerated growth into the cloud by companies as their workforces became de-centralised with work from home arrangements. With so much growth as a result it makes high-capacity drives very desirable to keep up with increasing storage demands and to keep costs down.

At 22TB per drive currently we've just about reached the limits of what conventional

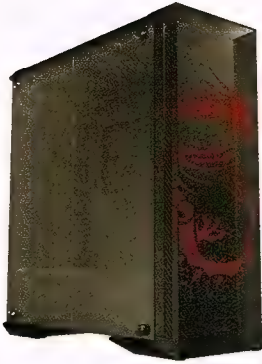
magnetic recording (CMR) is capable of. Western Digital created Enhanced PMR (ePMR) technology to further extend PMR (a form of CMR) technology potentially out to 30TB disks, but that's very much the end of the road for PMR/CMR. Western Digital early on when talking post PMR/CMR technologies was very invested in Microwave-Assisted Magnetic Recording (MAMR) but this was always just a stop gap to Heat Assisted Magnetic Recording (HAMR) which many now agree is the long term future path for HDDs. With ePMR now filling that gap, it appears MAMR has fallen by the wayside.

With Western Digital leaning on ePMR for as long as it can it means Seagate will be the first to market with its next-gen HAMR technology. And likely means that Seagate may have a technological advantage going forward over Western Digital and more experience with HAMR before Western Digital eventually comes to market with its own HAMR products. And Seagate isn't stopping there, with 5TB platters already functioning in its labs, Seagate expects 40TB+ drives to come during 2024-2025 and 50TB+ to come in 2026. ■



Market Watch

A sampling of PC systems available this month.



CPL ONLINE RYZEN 5 RTX 3060 TI DRAGON

\$2,369 | tinyurl.com/APC518CPL

The CPU and GPU pairing in this system is great, and neither will hold the other back when gaming. The liquid-cooled CPU is no slouch even with a beefier GPU but with the extra cooling overhead available, and better AM4 CPUs available, upgrading this system later for more performance will be a cinch, especially with the X570 motherboard.

The included RAM is also well chosen, being the sweet spot 3600MHz speed that Ryzen 5000 CPUs love. The oversized for this build PSU encourages future system upgrades too. Dual SSDs mean there's a lot of mass storage to last you years.

It's a nice and well-considered PC for those looking to start gaming at 1080p or 1440p with good potential for upgrades later as needed.

CPU: AMD Ryzen 5 5600X; **Cooler:** MSI MAG CoreLiquid 240R V2; **Motherboard:** MSI MAG X570S Tomahawk Max WIFI; **Graphics:** MSI GeForce RTX 3060 Ti Gaming X 8G LHR; **Memory:** Corsair 16GB DDR4 3600MHz; **Storage:** Crucial BX500 2TB SATA SSD, Crucial P3 500GB PCIe M.2 SSD; **Power Supply:** MSI MPG A850GF 850W; **Case:** MSI MPG Gunir 111R.



UMART G7 ULTRA

\$3,699 | tinyurl.com/APC518UMT

This system offers good firepower for its price with only a couple of minor let downs. The i7 CPU provides virtually all the gaming performance of an i9 without the throttling and heat issues. The 240mm AIO will suffice although a 360mm would've been ideal with these hot 13th Gen CPUs.

Though the RTX 4070 Ti is solid, offering RTX 3090 Ti levels of performance, the 12GB VRAM could hinder 4K performance down the road. The older Z690-based motherboard is fine as there's not much being missed out on versus the newer Z790 chipset. Being DDR4 it saves on costs with the RAM, but it also means the CPU can't fully stretch its legs. A solid build that keeps the price in check.

CPU: Intel Core i7 13700KF; **Cooler:** be quiet! Pure Loop 2 FX 240mm AIO; **Motherboard:** Z690 DDR4 based **Graphics:** MSI GeForce RTX 4070 Ti; **Memory:** Kingston 16GB Fury Beast RGB 3200MHz DDR4; **Storage:** 1TB NVMe SSD; **Power Supply:** 850W; **Case:** be quiet! Pure Base 500FX.



PLE COMPUTERS ACE MINI

\$4,285 | tinyurl.com/APC518PLE

Weighing in with a heftier price than the Umart G7 Ultra system while still performing in the same class, what does the extra \$500 on the price tag here get you? A beefier CPU cooler with a 360mm AIO, and there's also a newer Z790-based motherboard for more PCIe 4.0 lanes and faster memory support, which unfortunately is entirely negated by being a DDR4-based board instead of DDR5, making the dearer Z790 motherboard basically a waste of money.

An average DDR4 kit and smaller capacity SSD and power supply relative to the Umart offering begin to tip this system into a not-good value proposition. Just like the performance, the case aesthetics are fantastic and help the system at least look like the asking price.

CPU: Intel Core i7 13700KF; **Cooler:** ID-Cooling ZoomFlow 360 XT Snow 360mm AIO; **Motherboard:** Asus ROG Strix Z790-A Gaming WIFI D4 DDR4; **Graphics:** Asus GeForce RTX 4070 Ti TUF Gaming 12GB GDDR6X; **Memory:** Corsair 16GB Dominator Platinum RGB C16 3200MHz DDR4; **Storage:** Samsung 980 Pro 500GB M.2 NVMe SSD, WD Blue 1TB; **Power Supply:** Thermaltake Toughpower GF3 750W ATX 3.0; **Case:** Fractal Design Torrent Compact TG Mid Tower.

NZXT STREAMING PLUS PC

\$2,799 | tinyurl.com/APC518NZX

Nzxt is offering some decent value with this system. The 5800X is a good pairing for the RTX 3070 Ti. Cooled by a 120mm AIO, it offers solid gaming performance and decent performance for those dabbling in productivity work or game streaming. The AIO will restrict future upgrades as 12 and 16-core AM4 parts will overwhelm it. 16GB of RAM is the sweet spot these days although at 3200MHz it's a little below the speeds Ryzen 5000 ideally likes. The 1TB SSD is a big tick at this price too. Overall, lots of performance and value here, a tad CPU-heavy compared to rival options at this price but that just means a drop in GPU upgrade later won't cause as much of a bottleneck.

CPU: AMD Ryzen 7 5800X; **Cooler:** Nzxt Kraken 120; **Motherboard:** B550 based; **Graphics:** GeForce RTX 3070 Ti; **Memory:** 16GB 3200 MHz DDR4; **Storage:** 1TB NVMe M.2 SSD; **Power Supply:** Nzxt C750 750W; **Case:** Nzxt H5 Flow.



Blueprints

Value- and performance-driven hypothetical builds

BUDGET

A perfect balance between price and performance.

Last issue, we paid more attention to the overall costs of the Budget builds and tried to level the playing field. With increases across the board for PC components, our costs had risen to the point where they weren't exactly budget builds anymore. So we made a few adjustments to bring prices down while still offering well-rounded PCs. With changes to the PSU, GPU, SSD, and HDD for the AMD machine, we managed to bring the price down, but a few extra swaps this time around have lowered it even further.

First, we swapped out our Asrock X570 Steel Legend ATX AM4 motherboard and replaced it with an MSI B550M PRO-VDH WIFI Micro ATX mobo. Although it's a smaller Micro ATX form factor board, it does everything we need it to and saves \$66. Our biggest saving came when downgrading our GPU, instead of sticking with our Asrock Radeon RX 6600 XT Challenger D OC 8GB, we opted for a 6500 XT card, an Asus TUF Gaming OC Radeon RX 6500 XT 4GB GPU, saving us \$140. We kept the same HDD, SSD, and RAM configuration but chose a smaller PSU as the larger EVGA offering from the last issue was no longer on sale. These changes bring our overall price for the AMD machine down from \$1,446 to \$1,198 – a saving of \$248. There's a small hit to performance, due to our GPU and motherboard alternatives, but nothing that will be a major detriment to this build.

As for the Intel build, last time we brought down the cost to \$1,268 but, as with the AMD machine, we swapped our motherboard for an alternative Asrock model. Although



lacking a few features, this is the same B660M chipset. We also swapped out the GPU for a similarly performing card, this time an older Asus TUF Gaming EVO GeForce GTX 1660 Ti OC 6GB. With comparable performance to the RTX 3050 card before it, we saved an extra \$110. Finally, we opted for the same PSU from the AMD budget machine, bringing the total down to \$1,268.

AMD INGREDIENTS

Part		Price
Case	Corsair 4000D Airflow	\$159
PSU	450W EVGA 450 BR Bronze 80+ Gold NEW	\$74
Mobo	Asrock B660M-HDV Micro ATX LGA1700 NEW	\$159
CPU	AMD Ryzen 5 5600X	\$209
GPU	Asus GeForce GTX 1660 TiTUF Gaming EVO OC 6GB NEW	\$379
RAM	16GB (2 x 8GB) PNY XLR8 Gaming EPIC-X RGB DDR4 @ 3200MHz	\$88
SSD	500GB PNY CS2140 PCIe 4.0 M.2 SSD	\$55
HDD	2TB Seagate Barracuda Compute 7200	\$85
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	\$60
Total		\$1,198

INTEL INGREDIENTS

Part		Price
Case	Corsair 4000D Airflow	\$159
PSU	450W EVGA 450 BR Bronze 80+ Gold NEW	\$74
Mobo	MSI B550M PRO-VDH WIFI Micro ATX AM4 Motherboard NEW	\$179
CPU	Intel Core i3-12100	\$269
GPU	Asus TUF Gaming OC Radeon RX 6500 XT 4GB NEW	\$229
RAM	16GB (2 x 8GB) PNY XLR8 Gaming EPIC-X RGB DDR4 @ 3200MHz	\$88
SSD	500GB PNY CS2140 PCIe 4.0 M.2 SSD	\$55
HDD	2TB Seagate Barracuda Compute 7200	\$85
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	\$60
Total		\$1,268



"To keep our Mid-range machines balanced, we've made some changes to lower the price and maintain the performance."

MID-RANGE

A game-ready machine that can also handle demanding work.

As in our previous issue, we tried to cut down our prices for the Mid-range machines. It's difficult to do so while maintaining the same power and trying to keep your components up to date. Of course, compatibility also plays a part, and upgrading your CPU may also require a new motherboard or RAM.

So, to keep our Mid-range machines balanced, we've made some changes to lower the price and maintain the performance. Kicking off, we swapped out the AMD Ryzen 7 7700X for the AMD Ryzen 5 7600X. Granted, the 7700X is a great chip but for a mid-range rig, the latter fits the bill with six cores, 12 threads, and an impressive

max boost core of up to 5.3GHz. We introduced the Asrock Radeon RX 6750 XT Phantom Gaming D OC 12GB GPU last time around, but we're swapping that for a cheaper alternative, the Asus Dual Radeon RX 6750 XT OC 12GB, which comes in at \$649 – a saving of \$150. We also swapped out the ATX motherboard for a Micro ATX Asrock B650M PG Riptide WIFI mobo, saving a further \$130 over the previous Asrock B650E PG Riptide WIFI ATX. That's a total saving of \$372 this time.

Applying the same thinking to our Intel mid-range system, we reverted to the Intel Core i5-12600K from an Intel Core i5-13600K. We lose a little

performance and efficiency, but the 12600K is more than good enough to power our system and was \$80 cheaper. The Asrock Z690 Phantom Gaming 4/D5 motherboard went up in price, so we swapped it for the Gigabyte Z690 Gaming X ATX. The GPU had to change too, as the Asus GeForce RTX 3070 Dual V2 OC 8GB hiked up in price, so we brought in the Gigabyte Eagle OC GeForce RTX 3060 Ti 8GB card to replace it, at least until the 3070 cards fall in price. Both machines receive the EVGA 750 GA 80+ Gold PSU for under \$170, leaving us with a total gain of \$342 in pocket compared to last month's build.

AMD INGREDIENTS

Part		Price
Case	Nzxt H7 Flow	\$209
PSU	750W EVGA 750 GA 80+ Gold NEW	\$169
Mobo	Asrock B650M PG Riptide WIFI Micro ATX AM5 NEW	\$319
CPU	AMD Ryzen 5 7600X NEW	\$399
Cooler	Cooler Master Masterliquid ML240L RGB V2	\$109
GPU	Asus Dual Radeon RX 6750 XT OC 12GB NEW	\$649
RAM	32GB (2 x 16GB) Corsair Vengeance DDR5 CL40 @ 4800MHz	\$239
SSD	1TB Crucial P5 Plus NVME M.2 PCIe 4.0	\$145
HDD	2TB Seagate Barracuda Compute 7200	\$85
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	\$60
Total		\$2,383

INTEL INGREDIENTS

Part		Price
Case	Nzxt H7 Flow	\$209
PSU	750W EVGA 750 BP 80+ Bronze NEW	\$169
Mobo	Asrock Z690 Phantom Gaming 4/D5 ATX LGA 1700 NEW	\$299
CPU	Intel Core i5-12600K NEW	\$419
Cooler	Cooler Master Masterliquid ML240L RGB V2	\$109
GPU	Gigabyte GeForce RTX 3060 Ti Eagle OC 8GB NEW	\$599
RAM	32GB (2 x 16GB) Corsair Vengeance DDR5 CL40 @ 4800MHz	\$239
SSD	1TB Corsair MP600 PRO NH M.2 PCIe 4.0	\$199
HDD	2TB Seagate Barracuda Compute 7200	\$85
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	\$60
Total		\$2,387



"With the recent release of the next-generation Intel and AMD processors, Nvidia's 40 series GPUs, and AMD's latest Radeon RX 7000 series, these systems have some serious heat."

TURBO
The maximum PC.

For our top-tier Turbo machines, building a system with outright power in mind is the priority and keeping one eye on the budget can take a backseat here, well kind of. It would be easy to get carried away with adding unrealistic parts just for the sake of it, but these systems are designed to showcase some of the latest and greatest component configurations, after all. With the recent release of the next-generation Intel and AMD processors, Nvidia's 40 series GPUs, and AMD's latest Radeon RX 7000 series, these systems have some serious heat.

We can finally introduce the latest AMD GPU, the Radeon RX 7900 XTX. In the previous issue, these cards were

way over their RRP, but nobody wants to pay inflated prices, no matter how special the product is. This month, they're back down to where they should be, so out goes the XFX Speedster Merc 310 Black Edition Radeon RX 7900 XT 20GB and in comes the same model, but the XTX variant with 4GB of extra VRAM. There's no denying that this is a mighty powerful GPU – it has a boost clock of up to 2,615MHz and 24GB of GDDR6 this card can easily game at 4K on ultra settings with FPS scores of 90 and above. That's based on benchmarks with the AMD Ryzen 9 7900X, which we also have in this AMD Turbo machine. Unfortunately, that's the only change for the AMD rig.

Even that single change on the AMD side is more exciting than the complete lack of activity on the Intel Turbo rig. One possible reason is that we have recently added to both of these systems, so they are certainly future-proofed. The Asus GeForce RTX 4090 TUF Gaming OC 24GB is our weapon of choice here and remains in the build this month as it is still one of the 'cheapest' RTX 4090 cards you can pick up. We use that term lightly as it is still astronomically expensive, but it's the best available at the time of writing. Hopefully, we will get to see a slight decrease in RTX 4090 GPU prices soon as these cards rock, much like the performance of both of these Turbo systems.

AMD INGREDIENTS

Part		Price
Case	Phanteks Enthoo Pro 2 Tempered Glass	\$279
PSU	1000W Corsair RM1000 80+ Gold	\$299
Mobo	Asrock X670E PG Lightning ATX AM5	\$449
CPU	AMD Ryzen 9 7900X	\$689
Cooler	Cooler Master MasterLiquid ML360R RGB 66.7 CFM 360mm	\$159
GPU	XFX Speedster Merc 310 Black Edition Radeon RX 7900 XTX 24GB NEW	\$1,899
RAM	64GB (2x 32GB) Corsair Vengeance DDR5 CL40 @ 5200MHz	\$420
SSD	1TB WD Black SN850X M.2 PCIe 4.0	\$189
HDD	6TB WD Blue 5400 HDD	\$189
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	\$60
Total		\$4,632

INTEL INGREDIENTS

Part		Price
Case	Phanteks Enthoo Pro 2 Tempered Glass	\$279
PSU	1000W Corsair RM1000 80+ Gold	\$299
Mobo	Asrock Z790 PG Lightning DDR5 LGA 1700	\$359
CPU	Intel Core i9-13900K	\$929
Cooler	Nzxt Kraken X73 73.11 CFM 360mm	\$279
GPU	Asus GeForce RTX 4090 TUF Gaming OC 24GB	\$3,299
RAM	64GB (2x 32GB) Corsair Vengeance DDR5 CL40 @ 5200MHz	\$420
SSD	1TB WD Black SN850X M.2 PCIe 4.0	\$189
HDD	6TB WD Blue 5400 HDD	\$189
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	\$60
Total		\$6,302



techradar.com

QUICK TIPS

The problem solvers

The APC team field problems across the spectrum of devices and software.

Learn a new trick or fix you can use.

Secure dead laptop

My Lenovo Yoga laptop died last year and is still sitting in a drawer at home. I'd like to recycle it, but it contains lots of personal data that I can't delete because I can't boot it up. I thought of removing its internal storage but that's easier said than done because the unit is glued together. I've seen YouTube videos in which people use a heat gun to soften the glue so they can prise the back off. Is that really what you have to do these days to disable a redundant device? Or would you advise using a hammer?

Roger Hughes

APC responds: Taking a hammer to your Yoga might be tempting, but we wouldn't recommend it. The lithium-ion batteries in modern mobile devices are energy dense and, if pierced, can explode into flames.

Your question highlights a real concern, however, and there's no single solution. In your case, the best option is the one you suggested: open the device and remove the hard drive or SSD. You didn't say which model of Yoga you have, but iFixit hosts hundreds of illustrated guides that explain how to take apart various devices. The Yoga section is at (tinyurl.com/3rrrehyk).

When you get to the drive, you could remove it and smash it. But as it probably still works, a better option is to connect it to a PC using a cable. If it's a SATA drive, for example, you need a SATA-to-USB cable for around \$15.

AirPrint upgrade

I've been an avid reader of APC for many years, so I hope you can help me. I have a Canon MG6150 printer (pictured, below) that connects wirelessly to my PC. My children bought me an iPad, which I've tried in vain to connect to the printer.

Apparently, I need a printer that supports AirPrint, but mine doesn't. It seems a waste to replace a perfectly functioning printer, so I hope you can help me get around this problem.

Bill Green

APC responds:

You've already outlined the basic problem, which is that your printer doesn't support AirPrint. Your model was manufactured in 2010, a few months before Apple launched AirPrint. Since then, various developers have created paid-for Windows tools that attempt to bring AirPrint to incompatible printers.

However, finding ways around Apple's ever-evolving security is tricky for developers, so something that works today might not work tomorrow. That's why we don't recommend paying for any of these products.

So, where does that leave you? Well, you can print directly from SD memory cards. You could buy an adapter that lets you copy photos from your iPad to

an SD card via the Files app, then print them directly from this. Apple sells such an adapter, but it costs \$49. Thankfully, third-party adapters are available that work just as well but cost around \$20.

Or, you could upgrade your printer to one that supports AirPrint. Obviously, that's not the eco-friendly option, but most modern wireless printers, even the really cheap ones, do support AirPrint.

"My Lenovo Yoga laptop died last year and is still sitting in a drawer at home. I'd like to recycle it, but it contains lots of personal data that I can't delete because I can't boot it up."

Boot screen before BIOS

Every time I start my PC, a message appears telling me to press F1 to enter the BIOS settings. When I do this, it takes

me to a second screen. I don't have a clue what it is or what to do, so I just press F10 to select the 'Save and exit' option, and then the PC starts up and runs normally. Having to do this every time isn't good for my blood pressure. Can you help?

Ron Cushing

APC responds: This is usually a sign that the CMOS backup battery on your PC's motherboard has run out, which means that when you switch off the mains power to your PC, you are in effect resetting the BIOS. That's why your PC asks you to check the settings each time you switch it back on. Although having to press F10 to save and continue is an annoyance, it's no cause for alarm.

Fitting a new CMOS battery is usually an easy job. We gather from the photos of the BIOS screen you sent us that your computer has an Asus Prime B250M-K motherboard, so we can even show you exactly where the battery is. Buy a new CR2032 battery, then open the PC.

Simply prise out the old cell and pop in the new one. The next time you press F10 to save and exit the BIOS screen, your PC will save the settings, and you won't have to do it again in the future.

Back(up) to the future

I've finally decided to try installing an SSD in my PC, following your SSD



Canon's MG6150 doesn't offer AirPrint, but can print directly from memory cards.

feature in the October 2022 issue. However, I have some questions. First, how do I make a list of all the programs installed on my PC so I can reinstall them easily on my new drive? Is there a listing utility, or will I have to resort to pen and paper?

I've read online that I should do a clean install, but what about my Windows settings? Finally, would copying Thunderbird's 'xxxxx.default' directory to the new drive keep all my calendars, emails, and contacts intact?

Alan Brown

APC responds: You can view a list of your apps by clicking Settings followed by Apps, then 'Apps & features', but Windows doesn't provide an easy way to print it. Thankfully, NirSoft's free UninstallView tool can help. Download the program from (tinyurl.com/5n6k6fh2), launch it, then press Control-A to select all listed apps. Now open the File menu and choose Save Selected Items. Type a name for the file, then click Save to create a text file containing a list of all installed apps.

Your Windows 10 or 11 settings should be automatically synced via your Microsoft account. Click Start followed by Accounts and then 'Sync your settings', and then ensure the 'Sync settings' switch is in the On position (along with the various switches below it).

As for your Thunderbird question, the short answer is yes, copying this directory will work. Good luck, and enjoy your new SSD!

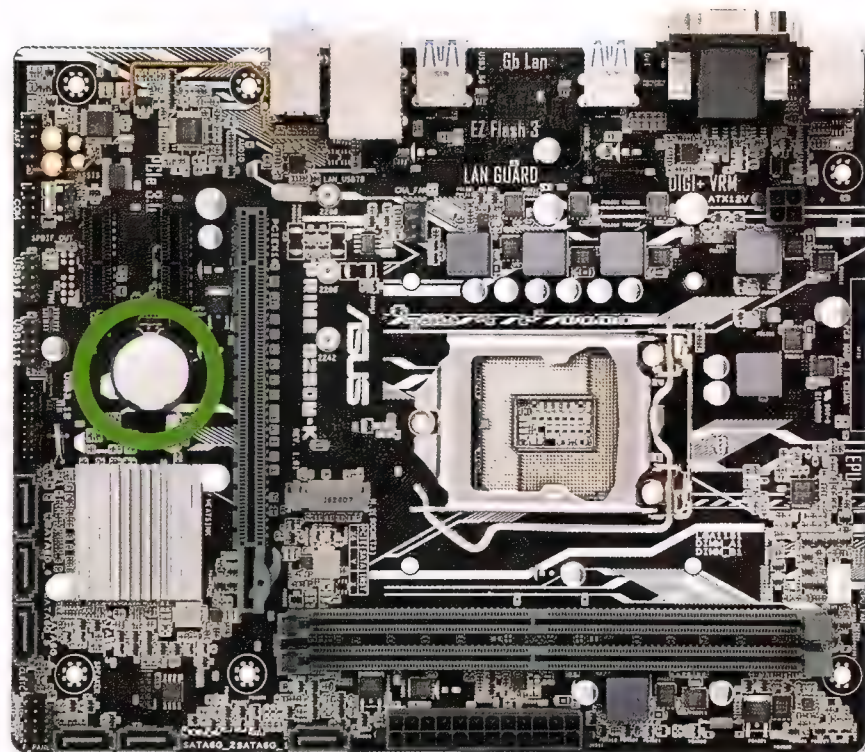
Unresponsive File Explorer

Something weird is happening in Windows. I can drag, drop and double-click files as usual, but as soon as I right-click a file or folder, File Explorer becomes unresponsive. How do I fix this?

William Erickson

APC responds: The culprit is probably a piece of third-party software that has added a shell extension to the right-click context menu in Windows. To locate it, we recommend downloading the free ShellExView tool (tinyurl.com/35cwcypy) from the ever-reliable NirSoft.

Once installed, launch the program then choose Options followed by 'Filter by Extension Type'. Click 'Context Menu' so it's the only entry that's highlighted, then click OK. Now click the Company column header, which



If your PC is forgetting its BIOS settings, replace this battery.

sorts the entries so that those from developers other than Microsoft are grouped together. These are marked in pink.

Next, hold down the Shift key while clicking on the first and last pink entry to select them all. Right-click the selection and choose Disable Selected Items, clicking Yes when prompted. Now choose Options, Restart Explorer (again, click Yes when prompted). Try right-clicking, and if the problem has gone away, you know one of the entries you've disabled is responsible.

From here, re-enable entries one at a time, restarting File Explorer after each one to see if the problem reappears. Once you've identified the culprit, leave its shell extension disabled or uninstall the program.

Memory stick madness

I've got a 32GB USB memory stick that I've had for several years and has always worked well. Recently, I tried to copy a 10GB video file to it, but Windows 10 told me there wasn't enough room. I checked and there was well over 20GB free. I know the stick has the advertised 32GB capacity because in the past I have copied nearly 30GB of files to it. I was able to copy other video files to it without any problems, but not this large one. Any idea what's going on?

Seb Freeman

"Every time I start my PC, a message appears telling me to press F1 to enter the BIOS settings."

APC responds: Yes! When you bought your stick, it was probably formatted with the FAT32 file system. This is common, because FAT32 is compatible with a diverse range of devices, from Windows PCs to in-car stereos. However, for trivial historical reasons, FAT32 imposes a 4GB size limit on individual files. So, while you could copy several 4GB files to your stick without complaint, it would refuse to hold even a single 5GB file.

So that's probably the cause of your problem. The solution is to format the stick using a different file system. Modern Windows PCs use the NTFS file system, which removes almost all practical limits on file and partition size, but it might create

compatibility problems with devices that don't run Windows. A much better file system for memory sticks is exFAT, which offers excellent compatibility but is a fraction slower than NTFS.

Formatting a memory stick is quick and easy, but bear in mind that it erases the contents, so make sure you copy anything you need from it first. Then, in File Explorer, right-click the memory stick and choose Format. Next, in the Format box, open the 'File system' dropdown menu and choose exFAT. Finally, tick the Quick Format box, then click Start. ■

Block all adverts in Windows

Microsoft is peppering its operating system with nags, nudges, recommendations and offers. Nik Rawlinson explains how to eradicate these annoyances.

These days many people don't have to pay to get a new version of Windows – they simply upgrade for free. Perhaps that's why Microsoft is now increasingly trying other ways to recoup its costs, including splashing adverts across its operating systems (both Windows 10 and 11). They're popping up in the Start menu, Cortana, Action Centre, the lock screen and more.

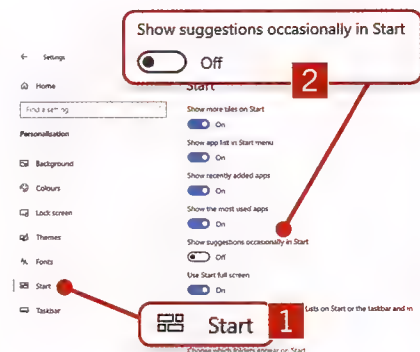
Most of the adverts originate from Microsoft itself, and are mostly offers for its paid-for subscriptions and suggestions to perform tasks within Windows, rather than promotions from third parties, but they're annoying all the same. Here we explain how to block them.

Block ads in the Start menu and on lock screen

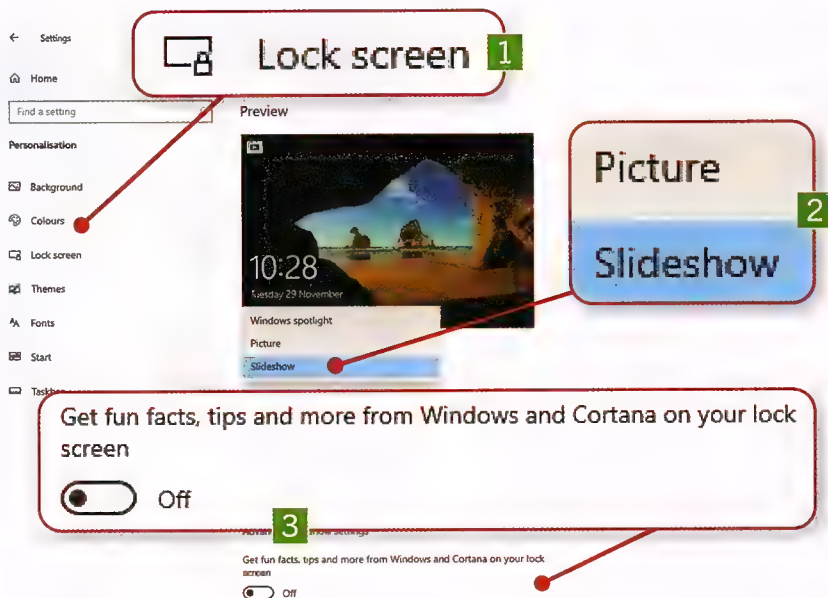
Let's start by disabling adverts in the Windows 10 Start menu. Press Windows key-I to open Settings, then click Personalisation, followed by Start on the left (1 in our screenshot below left). Click the slider below 'Show suggestions occasionally in Start' so it slides to the left, and turns from blue (on) to grey (off) (2).

While in the Personalisation section, also click 'Lock screen' on the left (1 in our screenshot above), then select either Picture or Slideshow in the Background dropdown menu (2) and turn off the slider below 'Get fun facts, tips and more from Windows and Cortana on your lock screen' (3).

In Windows 11, you'll find a



Disable suggestions in the Windows 10 Start menu by turning off this setting.



Turn off this option to keep your lock screen free of Microsoft's clutter.

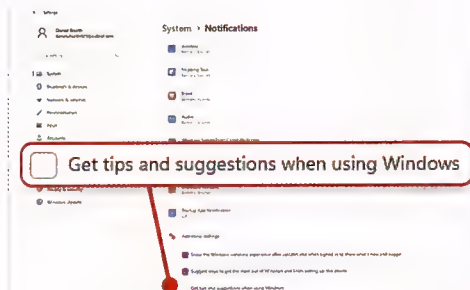
similar option to disable 'Get fun facts, tips and more on your lock screen' in the same settings location (this doesn't mention Cortana because it's not a default feature in that operating system). You'll find a box you need to untick rather than a slider to turn off.

Turn off ads in the Action Centre

Adverts are also popping up as notifications in the Action Centre, which is the panel that appears when you click the speech bubble to the right of your taskbar in Windows 10, or the clock in Windows 11.

To disable these notifications in Windows 10, return to the main Settings page, then click System followed by 'Notifications & actions' on the left. Here, untick 'Get tips, tricks, and suggestions as you use Windows'. If you're using Windows 11, in Settings click Notifications in the main section of the window. Scroll down and click 'Additional settings', then untick the box next to 'Get tips and suggestions when using Windows' (see screenshot above).

The other two options in this section (in both Windows 10 and 11) are intended to help explain what's changed whenever your PC has been updated and to provide tips on how to get the most out of this updated version. Respectively, the options are 'Show me the Windows welcome



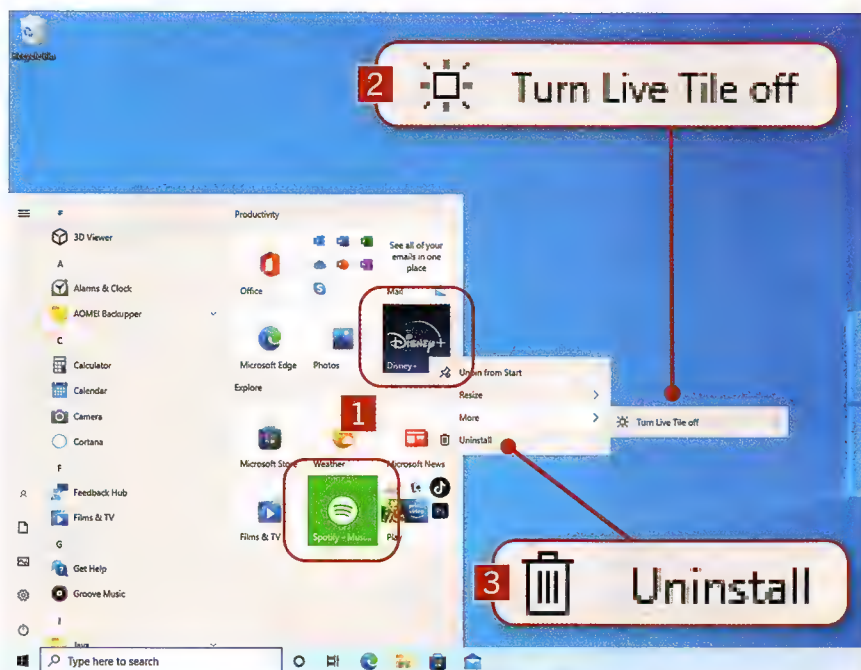
Untick this option to prevent persistent notifications from the Action Centre.

experience after updates...', and 'Suggest ways to get more out of Windows...'. If you don't think you need this kind of help, unticking these stops Microsoft's messages.

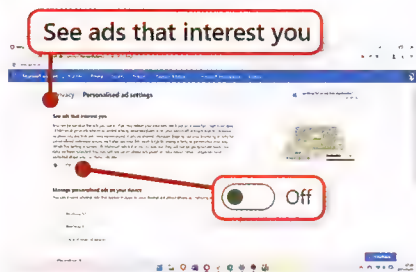
Remove ads from the Start menu

Sometimes, what seems to be an advert is actually a program that was installed as part of a Windows update. For example, recently in some countries – including the UK – Microsoft installed apps for Disney+ and Spotify, even if you had never previously used them. These appeared as live tiles in Windows 10 (1 in our screenshot above), and on the Start menu in Windows 10 & 11.

To remove a Windows 10 live tile from the Start menu and reclaim the space used by a program you need quick access to, right-click the tile



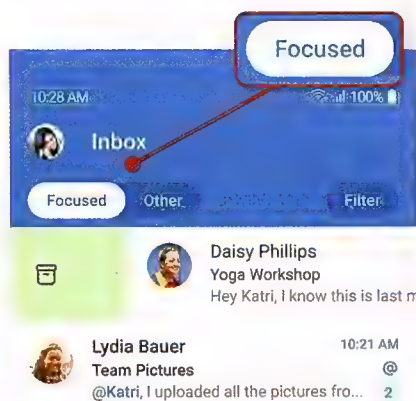
Turn off live tiles in Windows 10 to block any more adverts for apps like Spotify.



Turn off this setting to stop Microsoft showing you adverts based on your interests.

and hover over More, then click 'Turn Live Tile off' **2**. If you think you'll never use the associated program and would rather remove it, click Uninstall instead **3**.

To uninstall a program from Windows 11, or a Windows 10 program that doesn't appear as a live tile, right-click its entry on the Start menu, then click Uninstall.



Select the Focused inbox in the Outlook phone app to force ads into the 'Other' inbox.

Stop Microsoft tracking you

Some of Microsoft's adverts you just can't block, though at least you can stop the company tracking you so the ads aren't personalised to your interests. Log into your Microsoft account at account.microsoft.com, then click Privacy on the blue bar at the top of the screen. Scroll down to 'More privacy settings' at the bottom of the page, click 'Review ad settings', then switch off the slider below 'See ads that interest you' (see screenshot above).

Back in Windows, you can opt out of tracking when browsing with Microsoft's Edge browser. Click the three dots to the right of the address bar, then click Settings. Click 'Privacy, search, and services' in the sidebar, and make sure the slider next to 'Tracking prevention' is switched on (to the right). Based on the descriptions displayed choose between Basic, Balanced or Strict tracking prevention by clicking one of the boxes below. Some websites may not work as expected if you enable the Strict option so switch back to Basic or Balanced if you have any problems.



Adverts are appearing in the Outlook app disguised as normal messages.

BLOCK ADS IN 'SPLASH SCREENS'

Even if you block adverts in Windows itself, you'll still see advertising online – and some of this may creep into programs that pull in promotions to display on splash screens that appear when they first launch. These have nothing to do with Microsoft or Windows, and are more difficult to block since the process to do so varies for each developer.

However, you can usually stop splash screens showing at all, which is an alternative (and effective) way of tackling the problem. Look for an option to 'Show at launch' at the bottom of the screen and, if it's ticked, untick it. If there is no option, open the program's Settings or Tools menu, and look for a similar setting.

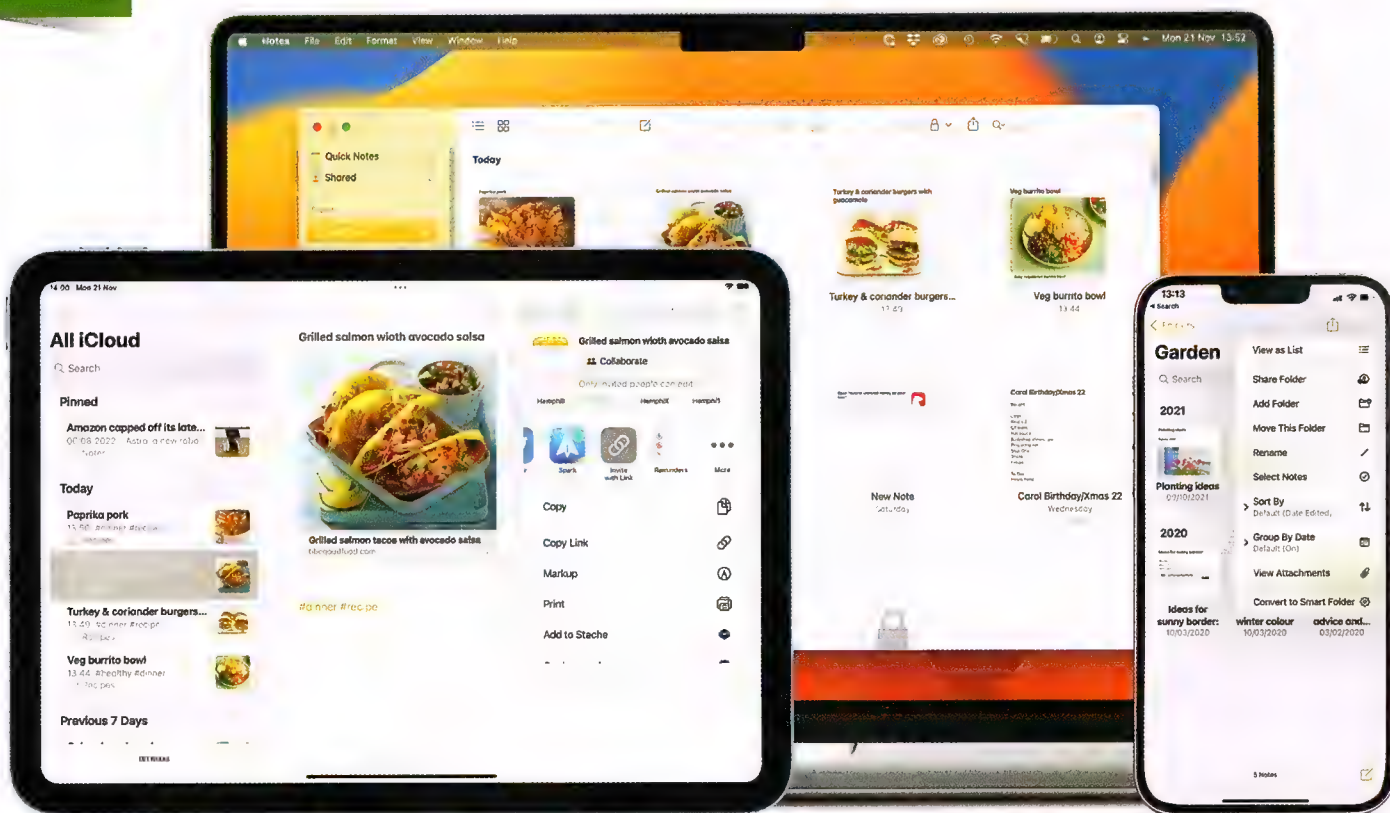
Disable ads in Outlook

Adverts are also now appearing in Outlook.com's interface, unless you have a Microsoft 365 subscription. A subscription for home use costs \$99 a year for a single user, and \$129 a year for a family membership, which can be used by up to six people.

You may also have noticed ads appearing as what look like ordinary messages in the Outlook app for Android or iOS. Microsoft confirms on its support pages that Outlook Mobile is an "ad-supported product for free users" (www.snipca.com/44282). The company points out that these adverts are indicated by the word 'Ad' inside a blue box (see screenshot left).

The app lets you organise your emails into a single inbox containing every message, or you can split it into two inboxes – 'Focused' for important emails, and 'Other' for the rest. It distinguishes these based on which emails you open and reply to. Emails from loved ones will appear in Focused, for example, while newsletters you rarely bother with get elbowed into Other.

Previously, Microsoft only put ads in the Other inbox for free users, but has recently started placing them in the single inbox as well. One way to see ads less frequently is to tap Focused above your messages (see screenshot left). This moves them automatically to the Other inbox. ■



MAC OS

Make the most of Notes

Discover all the new and useful features on offer in the Notes app.

IT WILL TAKE
5 minutes

YOU WILL LEARN
How to open and navigate System Settings to configure your Mac

YOU'LL NEED
macOS 13

Apple's Notes app was, for a long time, unloved both by users and, seemingly, by Apple itself. Updates were uninspiring and did nothing to help it compete with the dozens of other note-taking apps available for Mac, iPhone and iPad.

And there was a disastrous

dalliance with skeuomorphism when Apple decided it would be a good idea to make digital notes look like more like paper.

All that has changed, though. And the last couple of updates to all Apple's platforms have seen Notes improve in leaps and bounds.

More extensive features

The ability to share, lock, create and add to notes from anywhere using Quick Notes, and organise them using tags and folders have all made the app a genuinely useful tool and a serious option for anyone who has previously only ever considered using the likes of Evernote or Microsoft's OneNote.

Smart Folders now enable you to specify the conditions a note must meet to appear in the folder. And you can even collaborate on notes with other people and get updates on changes they have made to a note since you last viewed it.

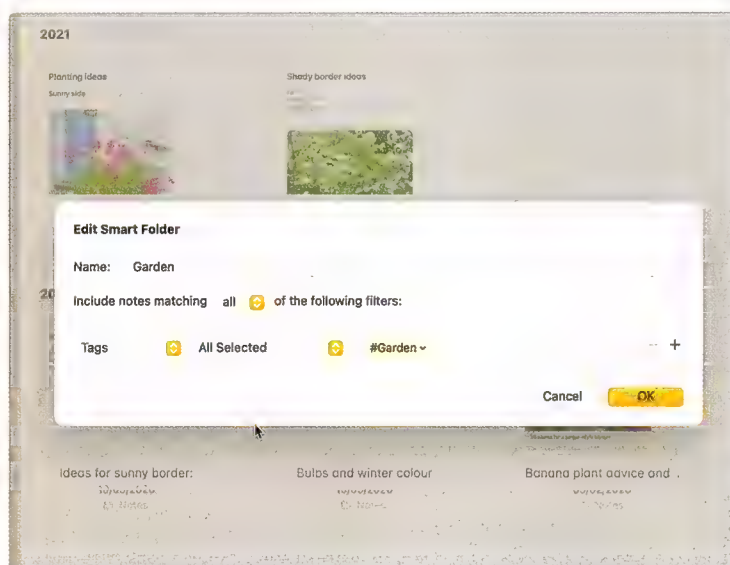
Notes also has a bunch of Shortcut actions, and there are several pre-cooked Shortcuts in that app's gallery that use Notes. We particularly like Day in Review which asks you questions about how your day has gone and what you hope for the following day and records it as note in Notes.

Kenny Hemphill



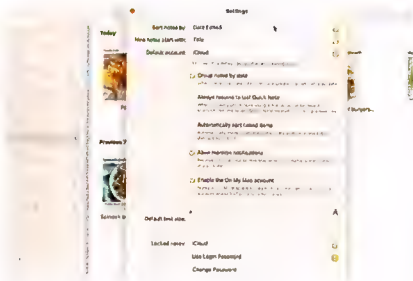
GENIUS TIP!

To enable access to Quick Note from Control Centre, go to Settings > Control Centre and tap '+' next to Quick Note.



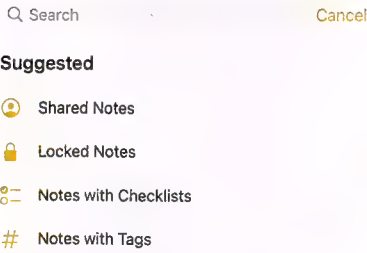
Notes now enables you to customise filters in Smart Folders to make it easier to find the note you need.

HOW TO USE THE LATEST FEATURES IN NOTES



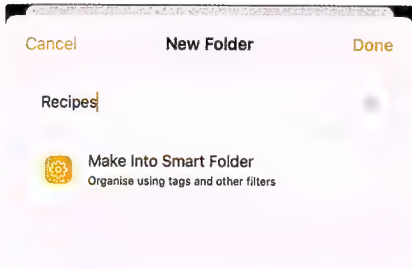
1 LOCK A NOTE ON MAC

Go to Notes > Settings and, in the Locked Notes section, choose options for locking notes. The default is to use your login password. Select the note you want to lock, click the padlock in the toolbar and choose Lock Note.



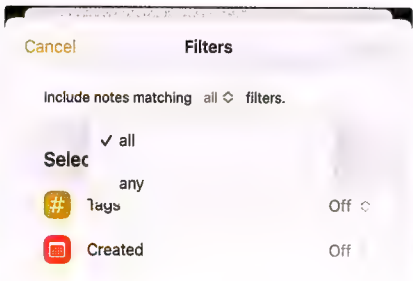
2 SEARCH FOR A NOTE

Tap or click in the search field. To look for notes in one of the Suggested groups, tap or click on the search term. Otherwise, type a term in the search field. You can use natural language like 'notes created last week'.



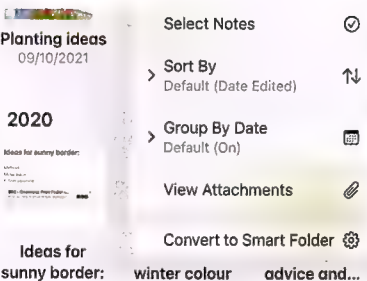
3 CREATE A SMART FOLDER

In the Mac version of Notes, click New Folder at the bottom of the sidebar; in iOS or iPadOS, tap the new folder icon, then On My Phone or iCloud. Type a name for the folder, and tap Make Into Smart folder.



4 DEFINE THE SMART FOLDER

After naming the folder, click or tap 'all' to choose whether all or any conditions need to be met. Tap a filter, choose the options for that filter, and then choose the parameters, like Tags > Any Selected Tag > [tag names].



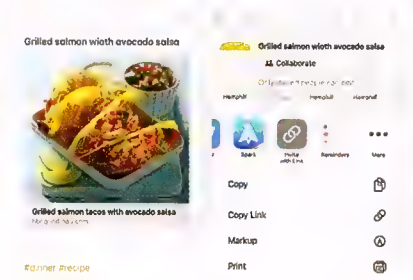
5 CONVERT A FOLDER

On Mac, select a folder then click the '...' button next to it. On iOS, go to the Folder view and tap Edit, then tap More. Choose 'Convert to Smart Folder', read the advice and, if you want to proceed, choose Convert.



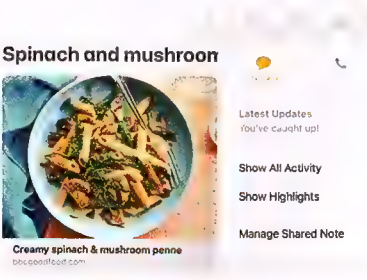
6 USE QUICK NOTES ON IOS

From any app on iPhone, tap the Share menu and choose 'Add to New Quick Note'. A Quick Note will open with a link to the document in the app. Add your own text, images or links to the note, then tap Save to save the Quick Note.



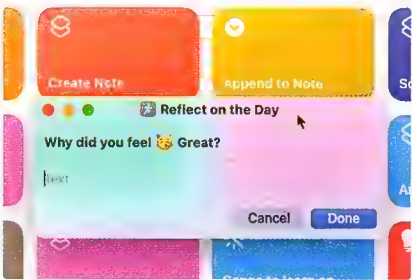
7 COLLABORATE WITH A LINK

Select the note that you want to collaborate on and click or tap the Share icon. Choose Collaborate then tap or click 'Only invited people can edit' and choose your options. Click Invite with Link, type a name, then choose Copy Link.



8 MANAGE SHARED NOTES

Select a shared note and click the head and shoulders icon. To see what has changed since you last worked on it, choose Show All Activity or Show Highlights. To change sharing options, select Manage Shared Note.



9 REFLECT ON THE DAY

Launch the Shortcuts app and go to the Gallery. Search for Reflect. Click the '+' to add it to your Shortcuts. Activate Siri and say 'Reflect on the Day'. Answer the questions and, when you're done, the results will be saved to Notes. ■

MOBILE DEVICES

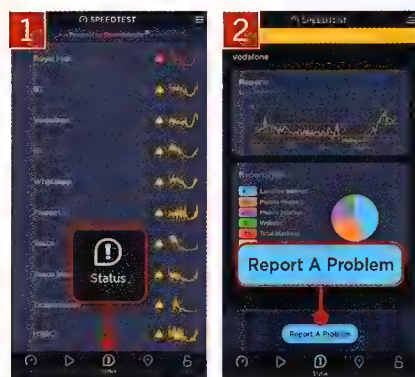
Phone and Tablet Tips

Brilliant things to do on your device

ANDROID & iOS Check if an online service has gone offline

When you're having problems accessing a website, app or your internet network, it's useful to know whether the problem is at your end or caused by the service you're using.

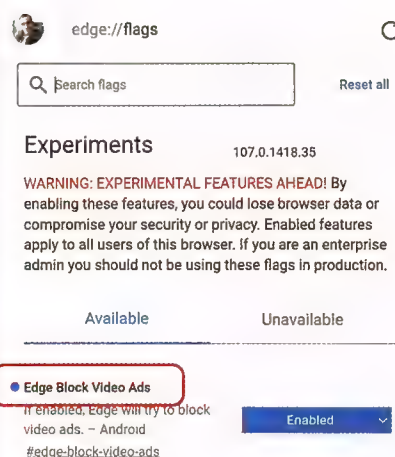
One of the best ways to find out is to check Downtdetector (downtdetector.com.au), which lets people report issues they're currently experiencing with online services. Downtdetector has now been integrated with the brilliant free app Speedtest by Ookla, so you can



quickly diagnose if there's trouble with your connection or if there's a more widespread fault.

To use this new feature, install the Speedtest app for Android (www.snipca.com/44118) or iOS (www.snipca.com/44119) and tap the Status tab at the bottom of the screen (see screenshot 1 below). This lists thousands of online services and tells you at a glance if they're presently offline or experiencing other problems – entries with a red line and exclamation mark at the top of the list have the most reported issues. Tap a service for a graph and pie chart showing the number of reports over the last 24 hours in a number of categories, including landline internet, mobile internet, TV streaming, email or total blackout. Tap the blue Report A Problem button 2 to share details of the trouble you're having and make Downtdetector's data more accurate.

This is a great addition to Speedtest, which has long been our favourite tool for checking a connection's download and upload speeds. It also includes a network-coverage map, a video-streaming test and a free VPN. When you first run the app, you can choose which



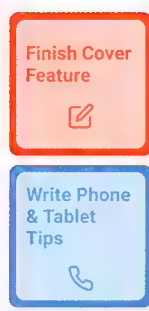
data to share – select 'Do not allow' for any options you're uncomfortable with.

ANDROID Block video adverts in Edge for Android

In the past, we've believed that the best way to block ads on YouTube is to watch videos in Brave Private Web Browser for Android (www.snipca.com).

BEST NEW APPS

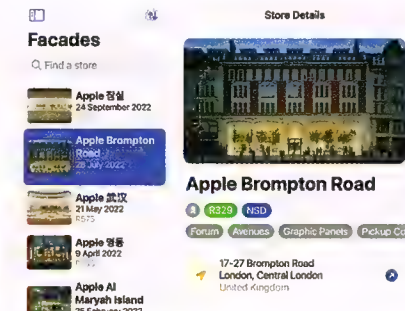
What you should install this month



TO-DO BLOCKS

Free | Android www.snipca.com/44123

Some to-do list apps are as hard work as the tasks themselves, but To-Do Blocks couldn't be simpler. Add a colour-coded block for each thing you need to do, including optional notes and an icon; rearrange blocks in order of importance; and tap a task to mark it as Done. The app also features a dark mode.



FACADES

Free | iOS www.snipca.com/44125

Apple fans will love this app, which lets you browse every current (and former) Apple Store around the world. Facades tells you when each store opened, its location, its design style – complete with illustrative photos – and its facilities, such as Pickup Counter. Tap through to the store's website to check for opening times.

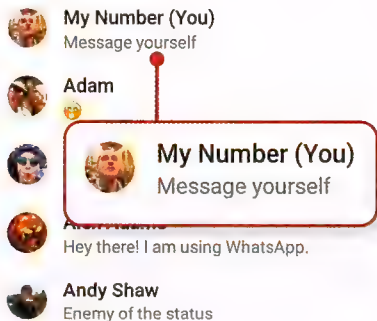


AMAZON PHOTOS

Free | Android www.snipca.com/44126
iOS www.snipca.com/44127

The redesigned Amazon Photos app for Android (the iOS version was updated in January) makes it easier to browse your gallery with one hand, and its improved search filters help you quickly find shots of places, objects and people. Tap the new paper-aeroplane button to share images and videos privately.

Contacts on WhatsApp



com/43958) and iOS (www.snipca.com/43959). There's now another way to avoid this nuisance using a secret option in Microsoft's Edge browser for Android (www.snipca.com/44120). This complements the Adblock Plus-powered ad blocker built into Edge – to switch this on, tap the three-dot button at the bottom of the browser and select Settings then 'Privacy and security'. Tap 'Block ads' and enable the 'Block ads' option.

To activate the new feature for blocking video ads, type **edge://flags** into Edge's address bar and press Enter to load the Experiments page. Search for the entry Edge Block Video Ads (see screenshot left), choose Enabled in the dropdown menu next to it and restart Edge.

When you visit YouTube or another video site, you should now be able to watch content without having to sit through annoying ads. Although the experiment states only that "Edge will try to block video ads", we found the feature worked very well, though we can't imagine Google will be pleased.

ANDROID & iOS Send WhatsApp messages to yourself

WhatsApp has added lots of useful features this year and is rounding off 2022 with the welcome new ability to send messages to yourself. This gives you a way to quickly save notes, reminders and interesting web links, and to test that content displays properly before you share it with other people.

To access this new option in WhatsApp for Android or iOS, tap the Message button in the bottom-right corner of the app's Chat screen. You will now see your own account at the top of the Contacts list, while the rest of your contacts are listed alphabetically. Tap your account name – this may be labelled 'My Number (You)' (see screenshot above) – and write a message as you would normally, attaching files or inserting emojis and GIFs as required. Tap 'Send' and the message will appear in your Chats list, so you can continue a conversation with yourself.

If you want to save a web page to read later, tap the Share button in your mobile browser, select WhatsApp and choose yourself as the recipient.

Note that the new 'message yourself' feature only works in the WhatsApp mobile app, not WhatsApp Web or Desktop, and is rolling out gradually, so you might not see it yet.

ANDROID & iOS Sign out of Netflix on specific devices

Netflix will soon start charging you to share your account with people who don't live with you, which could be a problem if you've already given your password to a friend, colleague or ex-partner. To prevent unauthorised access to your account, Netflix has added an option to its mobile apps and website that make it easy to view all devices on which you're currently signed in, and sign out of them with a single tap.

This is also handy if you've downgraded your Netflix account to a Basic plan – which only lets you stream to one device at a time. Previously, you could sign out of all devices at once, but the new feature gives you more flexibility.

To remove specific devices from your Netflix account, open the app on your phone or tablet and tap your profile picture in the top-right corner. Select 'Account', swipe down to 'Security & Privacy' and tap 'Manage access and devices'. This will list the most recently active devices on your account, the name of the profile and when and where they last watched Netflix. Tap 'Sign out' (see screenshot left) to disconnect them – you can change your Netflix password to stop them logging into your account again. ■



Manage access and devices

See the most recently active devices on this account. You can sign out any unfamiliar devices or change your password for added security.

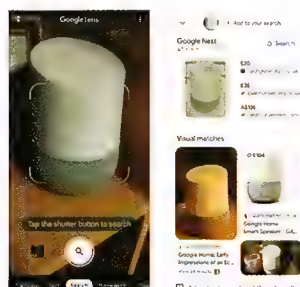
Amazon - Streaming stick

Ken (recently)
Last watched
Near Cumbernauld, North Lanarkshire
IP address

Sign out

Sign out

BEST APPS FOR... Reverse searches

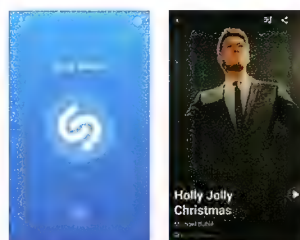


GOOGLE LENS

Free | Android www.snipca.com/44130
iOS www.snipca.com/44131

Use Google Lens to take a photo of any animal, plant or object, or choose a picture from your library, to look it up online and find out what it is. Its reverse-search results include visual matches on sites, which you can visit for more information. On iOS, you need the Google or Google Photos app to access Lens.

Best For: Identifying mystery objects

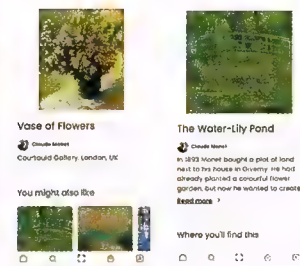


SHAZAM: MUSIC DISCOVERY

Free | Android www.snipca.com/44128
iOS www.snipca.com/44129

Shazam can identify virtually any song that's playing on the radio or TV, in a shop or restaurant, or anywhere else. Simply tap the button on its home screen and it will listen for music and tell you the name of the track. It's impressively fast and accurate, and provides lyrics.

Best For: Identifying unknown songs



SMARTIFY: ARTS AND CULTURE

Free* | Android www.snipca.com/44134
iOS www.snipca.com/44166

Art galleries rarely include much detail about their paintings, but Smartify will fill you in. Scan an artwork, sculpture or object in a museum or gallery and the app will identify it and provide you with a wealth of interesting information. You can also scan reproductions of pieces to discover where to find the originals.

Best For: Identifying works of art

LINUX

Nifty note-taking with Obsidian

Nate Drake walks you through adopting the almighty Markdown-based note-taking app Obsidian to see whether it lives up to its legend.



QUICK TIP!

If you haven't used Markdown before, check out Matt Cone's awesome guide at www.markdownguide.org. Both the Basic Syntax and Cheat Sheet pages have all the information you need to get started.



Obsidian's website describes the app as "a second brain for you, forever". In plain English, that means a tool that can help you take and organise a colossal number of notes in a simple way, from basic study notes to a full-blown wiki.

The program makes use of the Markdown markup language to format text, making it easy to import and export files. This simplifies tasks such as using links to jump between notes and organising large amounts of information.

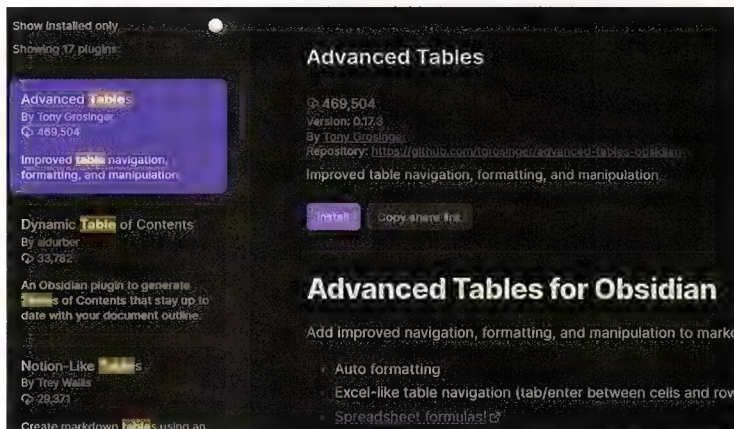
Obsidian is not FOSS but the free tier fully supports Linux, doesn't require registration and has some very powerful features. The program itself was developed by Shida Li and Erica Xu, who were unhappy with the existing note-taking software on offer.

There's also a thriving Obsidian community (<https://obsidian.md/community>) and a host of devs creating plugins to improve its rather minimalist interface.

Pick your package

Obsidian is extremely Linux-friendly, being available via Snap, Flatpak and an AppImage. Head over to <https://obsidian.md/download> to get started.

Ubuntu users will find it easiest just to click Linux (Snap) to download the file. Open the terminal and use



Expand Obsidian's features by installing free community plugins, such as Advanced Tables, which supports inserting Excel-like sheets.

`cd` to navigate to your Downloads folder. You can then use `snap` on the relevant file to install it – for example:

```
$ snap install --dangerous --classic
obsidian_1.0.3_amd64.snap
```

Note that because this is a third-party Snap file, you must use the `--dangerous` flag. You also need to enter your admin password. Once installed, Obsidian appears in Applications.

The Obsidian website, however, uses a large purple button to push the AppImage option, which has the advantage of working with virtually every flavour of Linux. The AppImage can also run directly from the folder where it's downloaded.

If you want to install this way, first make sure you have both fuse

and libfuse2 by running `sudo apt-get install fuse libfuse2` from the terminal. Next, right-click the file in your Downloads folder. Choose Properties and toggle Executable As Program. (Hardcore Linux users may prefer to use `chmod +x` to do this.) Next double-click to run Obsidian.

The installers weigh in well under 100MB, making Obsidian extremely lightweight.

One from the vaults

On your first launch, Obsidian offers three main options. Resist the urge to do a Quick Start and click Create to open a new so-called vault.

You first need to set a name for the vault, which will contain all the Markdown files for this particular project. Next, click Browse to choose where to save it. Obsidian automatically creates a folder with the project name – Lighthouse Project, for example – but we took the opportunity to create a parent folder for this and future vaults, imaginatively named vaults. Click Open, then Create to confirm your choices.

When the Obsidian dashboard itself launches, you'll see the interface is very spartan. This is deliberate and in keeping with the Markdown philosophy of having a simple, stripped-down text interface. On the plus side, it's easy to navigate.

Start your first Obsidian Markdown note by

Obsidian uses Markdown to easily link between different notes and images. The program suggests media in your vault as you type.

Which lighthouses?

I plan to begin by restoring 2 lighthouses:

1. Tungenes Lighthouse in Randagerg, Norway.

Fin: Statement of Intent
Tungenes Lighthouse

The tungenes.jpg

Type # to link heading. Type ^ to link blocks. Type | to change display text.

1. A \$250,000 donation from not-for-profit "Lighthouses-R-Us"
2. \$1.2 Million from an Angel Investor who wishes to remain anonymous.

clicking Create New File. We decided to begin with a Statement of Intent for our project. Change Untitled to give this note a name.

From here, you can enter text in Markdown format. If this is your first time using Markdown, we should explain that it's extremely easy to pick up. Obsidian has already created a main heading for you. You can also create subheadings by placing `##` before a new line of text. Use one or two `*` before and after text to make it italic or bold respectively.

You can also place web links in Markdown documents – for example:

My favourite magazine is [APC](https://apcmag.com/).

There are several ways to write lists. The simplest is to number them with a bracket – for example, 1), 2), 3) and so on – because Obsidian automatically recognises these and formats your text accordingly. Place a `---` to draw a neat line.

One particularly impressive aspect of Obsidian is that you can also paste in formatted text and it does its best to preserve the formatting. In our tests, we pasted in a paragraph from Wikipedia and all the special characters and web links were preserved. This may be a relief if you have existing documents that you want to use with Obsidian.

It's clear that Obsidian's developers have tried to make the editor as WYSIWYG as possible, although you can click the icon at the top-right to switch between reading and editing mode. Markdown purists may prefer to click the `...` options icon to switch to Source Mode to see the raw text.

Click the New Note icon at the top-left each time you want to create a separate file. Alternatively, click `+` to open a new tab and create or open a note from there to switch between them easily. All notes are saved automatically in Markdown format to your vault.

Pics and links

Markdown was built to allow easy cross-linking and sharing of info, and Obsidian has turned this into an art form. The easiest way to place an image inside a note is firstly to download it to the same folder as your vault.

Then, when inside a note, just type `![]` to open a small menu and select your image. Click to embed the image in your note.

OBSDIAN AUGMENTATION

Obsidian is designed to be a stripped-down note-taking app, ideal for importing existing projects or starting new ones. You can hugely expand its functionality, though, by using plugins.

To get started, you need to manually enable community plugins. Click the Gear icon on the bottom-left and choose Community Plugins > Turn On Community Plugins to leave Restricted Mode. Next, click Browse to see what's available. Search or scroll to find a plugin you like and click Open In Obsidian. Firefox asks you to confirm by clicking Open Link. Now click Install. Once installed, you may need to

click Enable to get it working.

We especially like the Day And Night theme, which lets Obsidian automatically toggle between modes, and Advanced Tables, which makes drawing tables much easier than typing them in Markdown.

The Calendar plugin allows Obsidian to display a simple calendar in the right-hand pane. (You need to click the Expand icon at the top-right to see this.) Click on a day to view your existing to-do list for that date or to create one.

Make sure you back up all your work first before installing plugins. You may need to restart Obsidian for them to take effect.



The graph view is an excellent feature for seeing all your notes in one place and how they relate to each other.

There may be times where you want to link to another note or picture without embedding the whole thing in the file. For instance, our Statement of Intent has links to other notes containing more information about the lighthouses we plan to restore. If you want just to include a link, simply type `[[` without the `!]`.

If you're managing a large project, navigating all these links and pictures may not be easy. To make life simpler, consider clicking the New Folder icon at the top-left to drag and drop pictures or notes into logical categories, such as images. Obsidian automatically updates any existing links.

For a full top-down oversight of your project, click Open Graph View in the left-hand pane. This is where Obsidian really comes into its own, because you can see the various links between notes and even group them in more advanced ways.

One good way to better organise your notes is by using tags. Tagging a note is just a matter of writing `#` anywhere followed by your tag – for

example, `#historynotes`. Click Open Graph Settings on the right while in Graph view to toggle displaying tags.

Observations

There's much to love about Obsidian. Setup is fairly easy and writing notes is a dream, even if you're not very familiar with Markdown. This article has focused on the free version of the app, which doesn't include the billable Sync and Publish services.

Sync enables you to save your notes in encrypted format across all your devices, though for only slightly more trouble, you can install a plugin to encrypt your notes (see boxout, above) and save them to a cloud folder. Obsidian supports exporting notes to PDF format and Markdown plays well with most word processors, but Publish is probably the best way to go if you want to transform your notes into a website.

If, however, you're happy putting time into learning Markdown and with taking notes on one device, Obsidian is very powerful and easy to navigate. ■

PI

Design and build a Pi robot

In his latest series, Les Pounder explains how to plan, design and build your very own Raspberry Pi robot from the basics up.

YOU'LL NEED THIS

- Robot kit
- Pi 3B+ or 4 GB
- 2x L298D motor controllers
- 12x female-to-female jumper wires
- USB battery for testing
- Code: tinyurl.com/APC518ROBOT

PART 2/3

Don't miss next issue, subscribe on page 21!

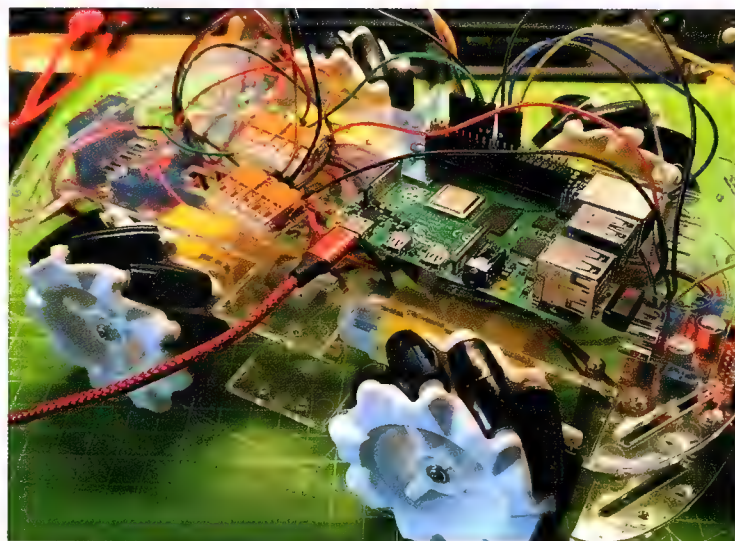


At the end of part one, we had built our robot from a kit and soldered wires from the motor terminals. In this part, we move on to writing code that will control the motors and move our robot. As our robot has four motors, we need to use two motor controllers. One for the rear motors, the other for the front. But which are the best choice for this project, and how do we interface the Raspberry Pi to them? We will create our own Python module (a library of prewritten code) to control the motors and create a test script to ensure it all works.

This part can get quite complex – we are working with four motors. Take your time, tackle just one motor at once, and double-check your connections before moving on. Sure, we want to get to the bit where our robot runs around under our command, but we need to put some work in before we reach those giddy delights.

Motor controllers

We can't just connect the GPIO of the Raspberry Pi to the motors. The amount of current consumed by a motor is many times what the Pi GPIO can produce. Instead we need something that sits between the Pi and the motors: a motor controller. The controller receives the signal from the Raspberry Pi's GPIO and triggers its output pins to send power to the motor. In reality, the motor controller is an H bridge, where changing the state of two pins



It may look a mess, but this robot is ours. We're still in the debug phase, so making it look pretty is not a concern yet.

can send the power to alternate motor pins. This forces the motor to spin in either direction, giving us directional control. The most common motor controllers for makers are the L9110S, L298N and DRV8833. But which one do we need?

To determine this we need to look at the datasheet for our yellow DC motors. It seems they have a max current of 800mA. This is the stall current, which is the current consumed by the motor when it is forced to stop – a wire may catch in the axle, or the robot becomes trapped. Looking at the datasheet for the L9110S, we see that it can handle 800mA, but only for one motor; two motors could see 1.6A go through and destroy the controller. We

tested the stall current for one motor and noted that it reached 900mA, which is a definite strike against the L9110S.

That leaves us with the DRV8833 and L298N. The DRV8833, a chip from Texas Instruments, has a maximum current, per motor channel, of 1.5A. Two motors running from one unit could pull 1.8A in a worst case scenario. So for now, the DRV8833 is a maybe.

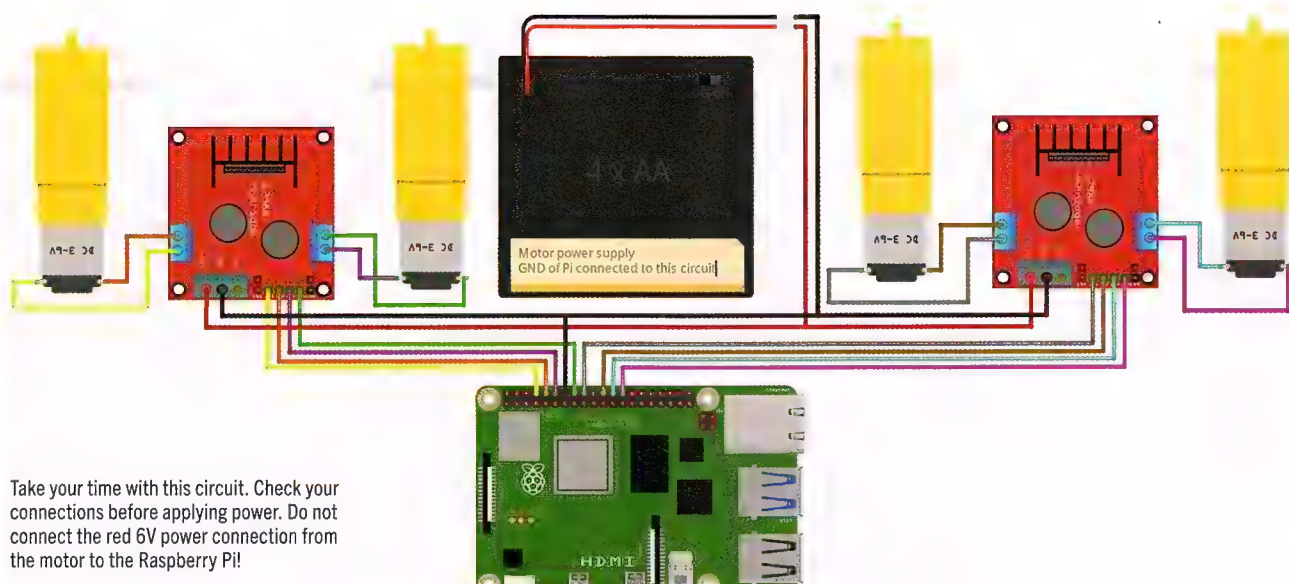
The final motor controller is the L298N, which is a beast of a motor controller. The L298N is the name of the chip itself, but it is commonly sold as the L298D, which features a breakout board for screw terminals and header pins. You'll also notice that the L298D has a massive heatsink. Well, it needs it as this chip can sink 2A per motor channel, over double the stall current of a single motor. This makes the L298D a great choice for this robot project. We are going to need two: one for the front motors, the other for the rear.

Connect the motors

Wiring up the motors to the controllers is an involved process, so let's do it one by one. We start with the rear motors. To wire up one motor we need the two wires from the motor

Cable ties are your new best friend. They can keep your components tight to the chassis, and clean up the mess of wires.





Take your time with this circuit. Check your connections before applying power. Do not connect the red 6V power connection from the motor to the Raspberry Pi!

connected to OUT1 and OUT2 on the L298D. It doesn't matter much which goes in OUT1/OUT2; we'll test that later. From the Raspberry Pi, connect GPIO14 to the IN1 pin, and GPIO15 to IN2. These pins control the motor rotation. Now we have one motor connected to the L298D, and our Pi is also connected.

Connect the second motor to OUT3 and OUT4, and GPIO18 and GPIO23 for the IN3 and IN4 pins. Connect the power from the batteries (or USB battery) to the 12V and GND of the L298D via a breadboard that we'll use to break out one connection into many. We also need to connect any GND from the Pi to the GND of the motors; use another series of breadboard connections for this. The batteries only power the motors, not the Pi. Four AA batteries is 6V, much more than a Pi can safely use. Right now we have two L298D motor controllers, powered from batteries/USB, with their GND pins connected to the GND of the Pi and the power source. This gives us a common ground reference necessary for the circuit to operate correctly. These two motors will be the rear-left and rear-right of the robot.

Now for the front motors, and for this we need another L298D. This time, connect the front-left motor to OUT1 and OUT2, then connect GPIO24 and 25 to IN1 and IN2 respectively. Connect the front-right motor to OUT3 and OUT4, and then connect GPIO8 and 7 to IN3 and IN4, respectively. Again connect the 12V terminal to the batteries via the breadboard, and connect GND to the breadboard row of GND pins. An alternative to a

breadboard are Wago 221. These are t that turn one connection, for example GND, into many GND connections. We can use a Wago 221 with five connections to common the GND of our Raspberry Pi and the battery. Another Wago 221 can be used to break out the 5V connection from the battery to both L298D motor controllers. See the picture above for an example of how we did this.

Testing time

Before we can set our robot off on an adventure, we need to ensure that we have full control of the motors. To do that we create a test script that checks that each motor can spin, and that we have control of the direction and speed. This test script is based upon GPIO Zero, an excellent Python module from Ben Nuttall and Dave Jones. GPIO Zero simplifies working with the GPIO by abstracting the complexities into human-readable instructions.

Begin by powering up to the Raspberry Pi desktop. From the main menu, go to Programming and select Thonny. In a new, blank window, save the code as robot-test.py. We start by importing two modules. The first is GPIO Zero, specifically the PWMOutputDevice class from it. This is used for fine control of the motor speed by sending pulses of current instead of simple on/off. The second module is time, and we use the sleep function to create pauses in the code:

```
from gpiozero import PWMOutputDevice
from time import sleep
```

Our focus now turns to creating objects that act as an interface between the code and

the GPIO pins that control the motor. The objects are given the cryptic names of rra and rrb. These refer to rear-right motor, and then one of two terminals represented by a and b. Object rra is the rear-right motor terminal a, connected to OUT1 on the L298D. This is controlled from GPIO14 on the Pi. The value of GPIO14 is set to 0 so that the motor doesn't automatically start. We repeat the process for rrb, connected to OUT2, IN2 and GPIO15.

```
rra = PWMOutputDevice(14,initial_value=0)
rrb = PWMOutputDevice(15,initial_value=0)
```

Here is the code for the left-rear

MOTOR CONTROL BOARDS

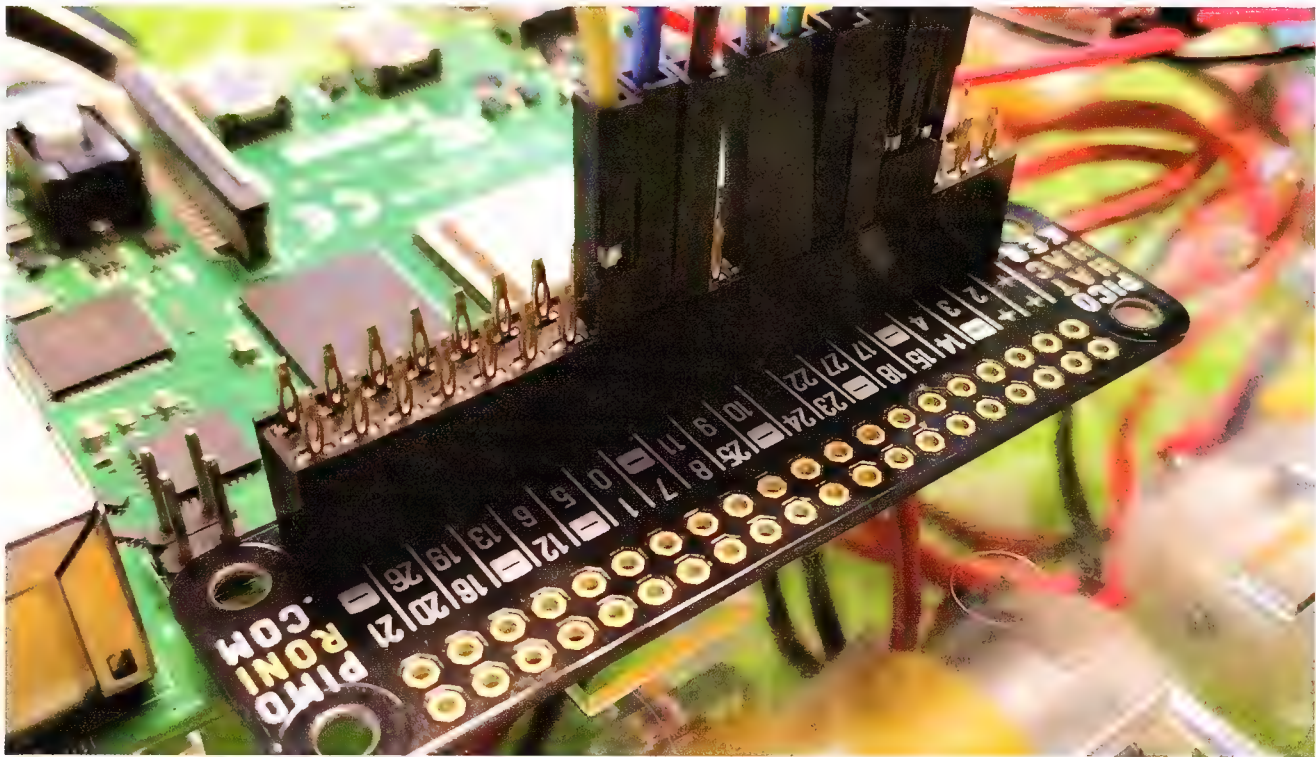
We've focused on bespoke H bridge motor controllers as the method to work with motors on the Raspberry Pi. They are not the only option, though. There are many other motor boards to choose from and here we highlight two that we have personally used. First is Pimoroni's Explorer HAT Pro, a board that was used in the Raspberry Pi Foundation's Picademy teacher training course. This versatile board has two motor outputs, capacitive touch inputs and 5V tolerant inputs. It is a great board for newcomers and while it isn't for use with big motors, for 6V micro gear metal motors, it is perfect.

The other controller is Cytron's Maker Drive, which is a breakout for an MX1508 motor controller. This tiny board is made for makers who want to get things to move. It has solid screw terminals, header pins for GPIO connections and, in a truly innovative move, push buttons. The four push buttons are used to test that a motor is connected and working. Press the button and it sends current along a set path, press another button and the H bridge flips and spins the motor in the opposite direction. We've used this board in a few projects, even with a Commodore 64 and a GPIO breakout to write Basic code to make a motor spin.



GENIUS TIP!

Wire up each motor individually. Check the connections match those in the table (see page 98). If your motor spins the wrong way, swap the connecting wires between the motor and the L298D.



We used a Pimoroni Pico HAT Hacker to help us remember the GPIO reference for each pin.



GENIUS TIP!

If you can't get any L298D motor controllers, a DRV8833 will do the job. The DRV8833 can cope with 1.5A of current per motor channel, but it is a little harder to work with.

motor, connected to OUT3 and OUT4 via IN3 and IN4 and GPIO18 and 23.

```
lra = PWMOutputDevice(18,initial_value=0) #left rear motor terminal a
lrb = PWMOutputDevice(23,initial_value=0) #left rear motor terminal b
```

Here is the code for the two front motors.

```
fra = PWMOutputDevice(24,initial_value=0) #front right motor terminal a
frb = PWMOutputDevice(25,initial_value=0) #front right motor terminal b
fla = PWMOutputDevice(8,initial_value=0) #front left motor terminal a
flb = PWMOutputDevice(7,initial_value=0) front left motor terminal b
```

Save the code before moving on.

For quick reference, below is a table of connections between the motors, L298Ds and Raspberry Pi GPIO.

To control the motors, we create functions for forward, backward and spinning motion.

Each function is named after the direction in which we want to go. The function takes an extra parameter, an argument, which is the speed at which we wish the motors to move, using a value between 0 and 1.

We start by moving forward using the forward() function. To move forward we need to spin the motors in the same direction. We set motor terminal a of each motor to run at the speed value we pass to the function. Motor terminal b is set to 0 so the H bridge in the L298D knows which direction the current flows.

```
def forward(speed):
    rra.value = speed
    rrb.value = 0
    lra.value = speed
    lrb.value = 0
    fla.value = speed
    flb.value = 0
    fra.value = speed
    frb.value = 0
```

Next we create a function called stop() to stop all the motors dead. No gentle deceleration – this is an emergency stop. It takes no argument.

```
def stop():
    rra.value = 0
    rrb.value = 0
    lra.value = 0
    lrb.value = 0
    fla.value = 0
    flb.value = 0
    fra.value = 0
    frb.value = 0
    print("ALL STOP")
```

Next we make a new line and write a few lines that call the functions to test that everything is working. We set forward to full speed, 1.0, but this can be any value above 0.5 for the test. Any values lower may cause the motor to stall, but later we can drop our speed down to lower than 0.5 while the motor is moving.

```
forward(1.0)
sleep(10)
stop()
```

Save the code and ensure the motor power supply is powered on and that the red LEDs on the L298D are lit. Lift the robot chassis up and ensure the wheels are clear of any objects and fingers. In Thonny, click Run and the motors spin. Check that each motor is spinning in the correct direction. If not, make a note and when the code stops, swap the

Object name	Motor pin	Motor input	Pi GPIO
rra	OUT1	IN1	14
rrb	OUT2	IN2	15
lra	OUT3	IN3	18
lrb	OUT4	IN4	23
fra	OUT1 (2nd L298D)	IN1 (2nd L298D)	24
frb	OUT2 (2nd L298D)	IN2 (2nd L298D)	25
fla	OUT3 (2nd L298D)	IN3 (2nd L298D)	8
flb	OUT4 (2nd L298D)	IN4 (2nd L298D)	7

motor terminal connection to the L298D for that motor and then try again.

Add more directions

With the successful test done, we add functions for backward, spin left and spin right. Place these below the forward() function, but above the test lines.

```
Backward
def backward(speed):
    rra.value = 0
    rrb.value = speed
    lra.value = 0
    lrb.value = speed
    fla.value = 0
    flb.value = speed
    fra.value = 0
    frb.value = speed
```

```
Spin left
def spin_left(speed):
    rra.value = speed
    rrb.value = 0
    lra.value = 0
    lrb.value = speed
    fla.value = 0
    flb.value = speed
    fra.value = speed
    frb.value = 0
```

```
Spin right
def spin_right(speed):
    rra.value = 0
    rrb.value = speed
    lra.value = speed
    lrb.value = 0
    fla.value = speed
    flb.value = 0
    fra.value = 0
    frb.value = speed
```

Now we can modify the test lines to use each function for five seconds:

```
forward(1.0)
sleep(5)
backward(1.0)
sleep(5)
spin_left(1.0)
sleep(5)
spin_right(1.0)
sleep(5)
stop()
```

Save the code, pick up the robot and click Run to test. Does every motor move correctly? If so you



A Wago 221 connector can turn one connection into many. We used it to make a common ground reference and break out the 5V power.

have completed the test and have a basic user-controllable robot. If not, swap the motor terminal connections between the motor and the L298D, and retest. In the download for this project is a quick reference table (Motor-Direction) of the values for each motor terminal.

Create a Python module

With a successful test under our belt we now move on to create a Python module that controls the robot. This is the easy bit. Copy all the lines from the imports and functions (we don't need the test lines), and paste them in a new Thonny window. Save it as robot.py.

Open a new Thonny window and use import the robot module and the sleep function from time:

```
import robot
from time import sleep
```

Add a few test lines that call the functions from the module and use them to control the robot. We preface commands with `robot` to tell Python which module to use. Save as test.py in the same directory as robot.py.

```
robot.forward(1.0)
sleep(5)
robot.backward(1.0)
sleep(5)
robot.spin_left(1.0)
sleep(5)
```

```
robot.spin_right(1.0)
sleep(5)
robot.stop()
```

Lift up the robot and click on Run. The robot should move in the same pattern as our previous test script.

To run the code remotely we need to start an SSH server. From the main Raspberry Pi OS menu, go to Preferences > Raspberry Pi Configuration. In the new window go to Interfaces and enable SSH. Hovering the mouse over the network icon in the top-right shows your IP address. On another computer, open a terminal window and use SSH to remotely connect to the Pi. You can use your IP address or hostname to connect. Typically the hostname is raspberrypi.local and the username is pi. So we would use SSH as follows.

```
ssh pi@raspberrypi.local
or
ssh pi@YOUR-IP-ADDRESS
```

Run test.py using Python (pick up the robot):

```
python3 test.py
```

And relax...

We now have a robot that we can code using a custom Python module. Next time we'll interface sensors into the robot to give it a level of intelligence that will see it navigate a room without outside help. ■



GENIUS TIP!

Writing a test script is essential. We need to make sure that we have full control of the motors before we unleash the robot. Getting the basics correct will yield better results for future parts of this series.

RASPBERRY PI ALTERNATIVES

The Raspberry Pi is not the only brains for a robot. It just depends on what level of intelligence you need in your bot. At the most basic level, we can use a \$5 microcontroller, such as an ATtiny85, to build a \$20 Arduino robot: <https://bigles/friday-fun-attiny85-10-robot-challenge>. If we want to use MicroPython or CircuitPython, we can build a robot based around the Pi Pico or Pico W. We can even use a TensorFlow Lite model to

give the robot intelligence to identify objects and obstacles, and react accordingly. The Pi is the sweet spot for computational power and price, but if money is no object, Nvidia's Jetson range of boards has superior AI and computer vision capabilities. The Nvidia Jetson has additional cores devoted to machine learning, and with a webcam, we can train our robot to detect faces and objects, hopefully with altruistic

intentions. Another option is Khadas's range of boards. The VIM4 is a beast of a board, with 8GB RAM and an octa-core Arm CPU. It runs Ubuntu 22.04 and is priced just over the currently high prices of the Pi 4. The Khadas Edge 2 Pro comes with up to 16GB RAM and a SoC that features additional computing power for machine learning. Sure, we pay more, but we get much more power for robotics in a tiny form factor.

GAMES

Dead Space

This remake is a promising portent for the series' future.

■ \$89.95 | PC, PS5, XBS/X | ea.com/games/dead-space



Dead Space was never a series about exploring the wonders of the universe or of space as a wild frontier where the worst evil we can imagine is corporate greed dominating the stars. No, this is a game about how space is downright scary; an abyss into which we gaze and see our nightmares reflected right back. If there's one thing I'm glad this remake didn't change, it's the Necromorph jumping-out-of-vent scream that almost sounds as if they're as surprised as you are. It's good to be back on the Ishimura, even if this is a remake instead of a fourth game.

This remake feels like a brand-new *Dead Space*. Sure, it's got the same bleak atmosphere, overarching narrative and the same ol' Necromorphs, but it could be the foundation for *Dead Space* moving forward; proof that this survival horror formula is as strong now as it was when the original launched in 2008. And I think a big part of this remake's strength is down to the fact that it builds on what

was already there, rather than trying to make something brand-new.

Dead Space manages more in ten hours than most games do in thirty, and that narrative has been further focused in the remake. Isaac actually talks now and this helps make him feel like an active participant in the story.

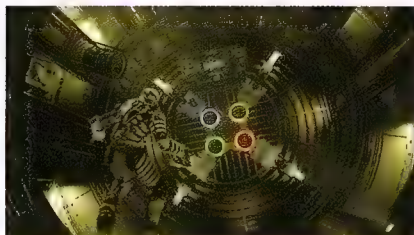
There was a lot of talk about the new horrendous-sounding Necromorph Peeling system in advance of the remake, but besides being a strong visual indicator of weakened limbs and what to chop, blowing more bits off Necromorphs is definitely a good time. My favourite thing has been blasting them point blank with the Force Gun and watching as an all-but-fleshless skeleton stands up like a chicken carcass put through one of those industrial blow dryers.

"Dead Space manages more in ten hours than most games do in thirty"

Another change is the inclusion of new no-gravity puzzles, and there's nothing quite like sitting back and floating as you try to figure out some complex space engineering problem. I found these sequences to be a nice respite from fighting Necromorphs, letting you think

about something other than alien amputation for a little while, and they're a strong addition to the remake.

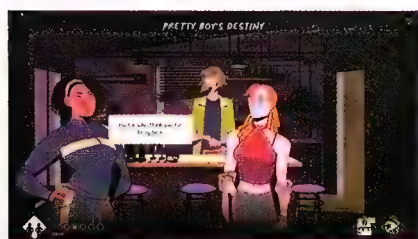
It took me around 12 hours to complete everything on medium difficulty, but the remake also features new game plus with harder enemies and 12 hidden marker fragments that unlock an alternate ending if found. So even though it's a little on the shorter side, this is what *Dead Space* has always been: an intense, momentum-driven experience. Most of all, I'm just happy *Dead Space* is back and *Dead Space* is good.



The *Dead Space* remake is a triumphant return for the beloved survival horror series. Hopefully more will follow.

Sean Martin

★★★★★



ROLLER DRAMA

A narrative game with a few bruises.

■ \$21.95 | PC, PS5/4, XB1, Switch | open-lab.com/games/rollerdrama

When it's not getting tackled by its own UI shortcomings, *Roller Drama* skates on its characters, art style, and the near unbearable responsibility of being a team coach. You take on the role of Joan 'Jeanne D'Arc' Galliano, a coach for a women's roller derby team. The game is split between the hijinks of keeping your team, plus their personal lives, in order and winning matches. It's part management game, part visual novel, though if there are branching paths in the story it was hard for me to notice.

Matches themselves are where you get to flex your head for strategy. You watch the game play out in real time from above, giving direct inputs to your jammer while giving instructions to the rest of your team, who have to balance breaking up the enemy defence, protecting their own jammer and slowing down the enemy team's jammer. It seems simple at a glance but timing and tactics really are difficult to get right, plus you have to manage your team's energy levels so they don't get exhausted before the match is over.

"It seems simple at a glance but timing and tactics really are difficult to get right, plus you have to manage your team's energy levels so they don't get exhausted before the match is over."

Unfortunately the game's puzzles are sometimes inscrutable. Almost every time a new quest was given for me to solve, I was immediately lost, failing to grasp the specific order of actions that had to be taken for things to be resolved.

Roller Drama is nice to look at while you struggle, at least. The character designs are fun but it's the big cross section of their house that I especially love, watching all the characters battle for use of the elevator. Despite the charming visuals, the UI is often unreadable, if not outright broken.

Issues like this are a shame, because when *Roller Drama* got out of its own way I became really invested in looking after my little team of lovable misfits. Like them, *Roller Drama* has a lot of flaws, but its heart and raw enthusiasm shines through.

Roller Drama from Open Lab Games is charming, but undermined by technical issues and obtuse puzzles.

Samantha Greer

★★★★☆

THE TELWYNM: BOOK TWO

Another memorable Powerhoof game.

■ Free | PC, Mac, Linux
powerhoof.itch.io/the-telwynium-book-two

I won't beat around the bush. *Telwynium* is at once a faithful love letter to *The Wheel of Time*, and a masterful subversion of it, recreating familiar story beats and characters, and then having shocking things happen to them.

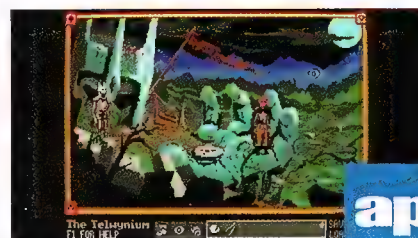
Visually at least, *Telwynium* is modelled after the old Sierra games of the early '90s, with EGA-style pixel art that matches Sierra for character and atmosphere, and adds more detail. These are beautiful environments to explore as Pendar, with Book Two in particular making up for its compact world with some rather beautiful vistas.

But while it looks like a Sierra game, it doesn't play much like one, ejecting their fiddly interfaces for a modern, streamlined approach. You have an inventory, and a small selection of verbs: walk, look at and interact. That's enough to forge some clever puzzles around, and they're a little better here in Book Two, with the NPCs more ready to help you, instead of finding flimsy reasons for Pendar to handle everything himself.

A small adventure that packs in a lot. It feels like the middle part of an epic fantasy trilogy.

Tom Sykes

★★★★☆



HUE FLOWING

A platformer dripping with style.

■ Free | PC | dafluffypotato.itch.io/hue-flowing

Filling in a map is one of the best things in games. The best and the worst, as you may find your perfectionist tendencies taking over. Surprisingly, that didn't happen for me in *Hue Flowing*, probably because it's only 15 minutes long.

The entire level is swaddled in a thick fog of war, and you can only clear it by jumping around. The arc of your jump removes the foggy top layer of the canvas, revealing a world of pretty floating islands below.

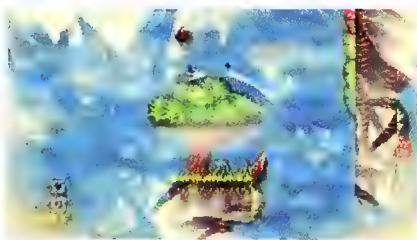
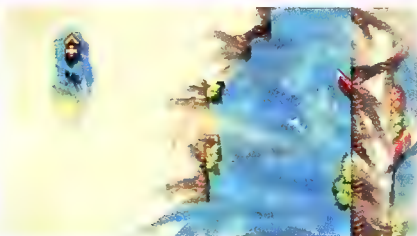
It is odd to jump in a platformer and not know if you're going to land safely on a platform, or tumble into the void. However, for the most part death is no bother, simply taking you back to the last platform you were on. Your first few minutes are a frenzy of leaping and drawing, as you gradually fill in the map.

The most satisfying thing about *Hue Flowing* is a visual effect that I suspect impacts the performance. Your leaping brush-strokes trickle down the screen, as if they're dripping water. It feels like you're painting with watercolours.

An enjoyable micro-platformer where you go from chump to God.

Tom Sykes

★★★★☆



COLOSSAL CAVE

An education in '70s adventure game design.

■ \$58.50 | PC, PS5, XBS/X, Switch | colossalcave3d.com

Colossal Cave is a new version of *Colossal Cave Adventure*, a text adventure from the late 1970s. While not the first attempt at a graphical reimagining of its namesake, it is the first to render the cave in full 3D, with WASD and mouse controls, leaving nothing to the imagination whatsoever.

The prose lives on as narration, which is thoughtfully implemented as a 'look' interaction attached to your cursor – always available to flesh out a scene or describe an object, but rarely forced upon you. And its presence allows you to appreciate just how faithful a rendition this is.

This game was in many ways a blueprint for the point-and-click adventure genre as we still know it today, asking you to scour the environment for objects to place in your inventory, and then to find places where those objects might be applied to allow you further progress. Ultimately, your goal is to find treasure that will contribute to your point total.

Considering its age, *Colossal Cave's* puzzle logic is surprisingly robust. But surrounding these puzzles are elements that have weathered the decades less well. Take the dwarves, who intermittently spring out of the

earth to hurl a knife in your direction. They usually miss, but an RNG-determined hit will kill you instantly, sending you back to the well house. Worse, resurrection has a cost, pulling directly from your point total – making a perfect score a frustrating ambition to reach for.

Then there are *Colossal Cave's* mazes, so notorious at the time that one repeated description, "You are in a maze of twisty little passages, all alike," has resonated across the years, becoming a byword in hacker culture for a situation in which no possible action affects the outcome. Escape is possible, with patience, but torment is inevitable. A fact which makes you wonder whether parts of *Colossal Cave* might have been better left buried deep beneath the rock. Both from a design and aesthetic perspective, there are far fairer caverns to delve into these days.

Colossal Cave is certainly One for nostalgists and those who just love getting lost on spelunking holidays.

Jeremy Peel

★★★★☆



AQUATICO

Create and manage an undersea metropolis.

■ \$35.95 | PC | overseer-games.com/aquatico

This is *Aquatico*, where you're building a city on the ocean floor after an asteroid strike has rendered the surface world uninhabitable. Instead of roads, you'll build pipelines, instead of city buses you'll have submarines, and instead of tornadoes you'll have to worry about shark attacks.

Despite *Aquatico*'s unusual setting, your city will grow and prosper based on many of the same elements found in city builders that take place on the surface. Mining for oil and stone, fabricating plastic and glass, farming for sustenance, and using turbines and solar collectors for power. Resource management is the real star of *Aquatico*, and there's loads of it to manage. Swift expansion needs to be tempered with the infrastructure to support it: build too quickly and red exclamation points will appear around the city signifying a deficit of fuel or oxygen. I found it a mostly relaxing experience to build in the bubbly blue depths, but it's livened up by moments of alarm and panic when I didn't plan ahead.

The growing city can also be highly enjoyable to just sit back and watch for a bit. Human workers clomp across the seabed in mech-like diving suits, aquatic drones speed through the water, grow and harvest crops, and carry supplies in their little mechanical claws. Automated submarines move resources between depots, warehouses, and the city

centre while all sorts of sea life glides over and through the city, from clouds of giant jellyfish to massive sperm whales.

Another bright point is an expedition system a bit similar to *Frostpunk*'s. After building a special hub, I can stock a submarine with human explorers and supplies and send it offscreen to investigate SOS signals, abandoned colonies, or new sources of food and resources.

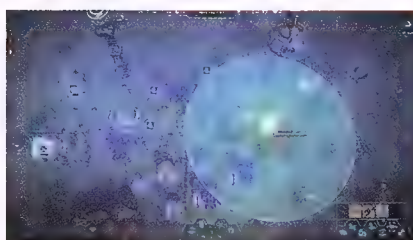
The resource management systems of *Aquatico* are pretty deep, and there are a lot of charming details and some inventive ideas in the undersea

builder. But like the water it's submerged in, my city wound up feeling cold. It's a nice place to visit, but I wouldn't really want to live there.

The resource management is deep and satisfying, but the city itself never quite feels like a city.

Christopher Livingston

★★★★☆



BATTLE OF WINDOWS

Imagines a civil war on your desktop.

■ Free | Browser | bit.ly/BattleOfWindows

Battle of Windows repurposes an old version of Windows. However, the titular windows are given unlikely utility. The windows of Windows have had a bit of a falling out, going to war in an aerial battle on your desktop. Enemy windows fly towards you from the right of the screen – as in a typical horizontal shmup – and, playing as a wizard, you have to fend them off by summoning windows of your own.

The cheapest window you can summon contains a clipart of a spaceship, which will automatically fire *Minesweeper* mines at the enemy. You can summon multiple ships, and position them wherever you want by dragging them around.

Walls physically restrain enemy windows, stopping them from reaching your wizard and reducing their health. Eventually, stronger enemies appear. So, you summon more walls, and more ships, and you chuck in a few of the playing cards as well, which will attack enemy windows at close-range. Soon the screen is full of windows, which you're furiously squishing and dragging around.

This is a great idea, taking the Windows we all know so well and finding a fun new use for it.

Tom Sykes

★★★★★



GAME CHANGER

The Witcher 2: Assassins of Kings

Coming to terms with not liking CDPR's breakout RPG. By Ted Litchfield

■ Release: May 17, 2010 Developer: CD Projekt Red Publisher: CD Projekt Link: thewitcher.com

CD Projekt Red recently unleashed *The Witcher 3: Next Gen*, a big ole 4.0 update with new items, quests, graphical enhancements, a revamped camera, and ray traced lighting that nobody's GPU can handle. It was, of course, time for a replay, and I'm obsessive and neurotic about these enormous RPGs where choices carry from game to game, so replaying *The Witcher 3* means replaying *The Witcher* saga. I tore through *The Witcher* making the same choices I always do (what kind of hall monitor sides with the Order of the Flaming Rose anyway?) and arrived at *The Witcher 2: Assassins of Kings*.

This is the game that put CD Projekt on the map, a graphical powerhouse that laid rigs low with ubersampling. It's a memetic icon of RPG choice with two completely different second

acts! Amidst the rise of tablets, the ascendancy of the Xbox 360, and a premature declaration of "the death of the PC," *The Witcher 2* said, "PC gaming ain't going anywhere, baby." But I've got a horrible, terrible, unspeakable secret: I just don't like this one very much.

The Witcher 3: Wild Hunt is easily one of my favourite games. It's one they hand you with your PC gamer card alongside *Half-Life* and *Doom* for a reason. The *Witcher*, meanwhile, is a wonderful, ambitious, Eurojank throwback. A charismatic relic that, despite a notoriously botched English translation, still has that wonderful pagan rites meet the Brothers Grimm vibe I've come to demand from the *Witcher*-verse.

I've always found *The Witcher 2* to be an awkward sophomore outing by comparison, an

untenable midpoint between the charming rough edges of *The Witcher* and the flawless excellence of *Wild Hunt*. *Assassins of Kings* is mechanically complex without being particularly deep, and it's guilty of the sort of overly edgy "this isn't your old man's RPG" writing critics usually ding *Cyberpunk 2077* for. But I opened my heart to the possibilities: I'd go for that alternate second act I'd never seen before and maybe try a different build, all in the hopes of discovering the game everyone found to be such a triumph over the first one.

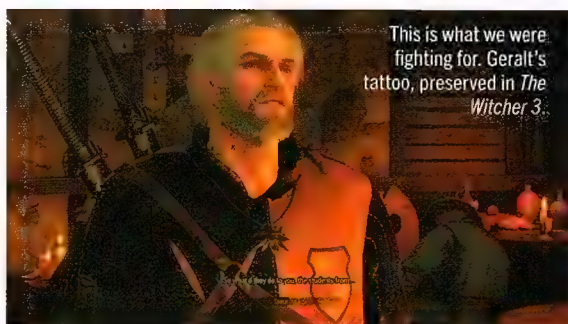
Second chance

Neither saved it for me. At the end of *The Witcher 2*'s first act, the fate of awful backwater Flotsam hangs in the balance! Do you side with elven terrorist beloved freedom fighter Iorveth in order to go after the kingslayer, or do



Left: *The Witcher 2* did initiate the series' excellent portrayal of trolls as slow but lovable dullards.

Above: Henselt's soldiers are all stinky and weird.



you pick medieval cop Vernon Roche so you can go after the kingslayer, but over here instead? I'm a creature of habit, if my repeated replaying of this 150-hour series wasn't indication enough, and I get really invested in my role playing, so when I come back to a moral choice I made the first time, I usually stick with my guns! Iorveth is

right, after all. Still, there's a whole chunk of this game I'd never seen before, so I gritted my teeth and aided grumpy swordy spec ops dad Roche instead. I thought, "What if the game everybody else thinks is so good is hidden away in Roche's Kaedweni camp adventure?"

To my great relief, it was not. As confounding as the political

manoeuvring in Iorveth's besieged dwarf town of Vergen is, it absolutely beats palling around with a gaggle of real assholes in King Henselt's miserable grey mud pit. The charm of *The Witcher*, for me, is how much this awful world can prove a glass half-full. This mutated killer we follow around is a warm hearted romantic with a wry sense of humour, and not all monsters need to be killed. Things can be grim and not always work out, but that levity provides a necessary contrast.

In Henselt's camp, there's really no such silver lining or pleasant surprise anywhere. The king himself is a petulant rapist and warmonger, and it sticks in my craw that *Assassins of Kings* presents a choice of killing him or not as some kind of weighty conundrum. His advisor, Deathmold, is a creepy torturer, and while Roche can be a real winner, I find most of his best moments are in *The Witcher 3*. As for the camp's second order inhabitants, it's a total bust. Vergen has all kinds

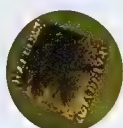
VENDOR TRASH

Why do I have all this crap?



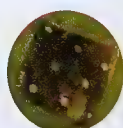
ROBUST CLOTH

There's regular cloth in *The Witcher 2*, but that won't do. It must first be transmuted into the venerable Robust Cloth, a key ingredient in the various jerkins, breeches, boots, and mittens you'll be chasing for incremental armour upgrades.



HARDENED LEATHER

You're going to need a ton of Hardened Leather to craft high-quality weapons. Vendors have a limited amount, so you'll have to go on a little quest getting regular leather you can craft into Hardened Leather.



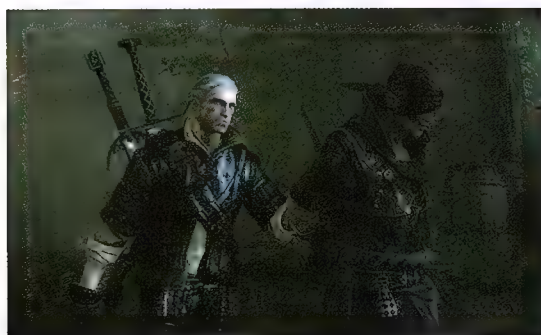
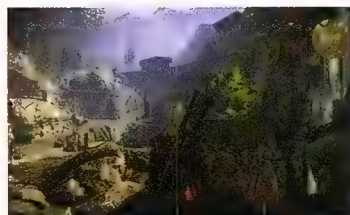
STUDDED LEATHER

Oh, and Hardened Leather can actually be crafted into Studded Leather. You'll need lots of Studded and Hardened Leather to outfit your six slots. I needed a paper and pen to calculate how much detritus I had to accumulate.



TIMBER

Alright, am I playing *The Witcher* or is this *Age of Empires* all of a sudden? Am I crafting silver swords, or a got a danged town centre to challenge the Ottoman Turks? Indicative of a deep identity crisis in *The Witcher 2: Assassins of Kings*.



Above: The armwrestling minigame is fun, but it's no Gwent. Right: There's just no beating the dwarf town of Vergen, the highlight of the game for me.

of colourful and eccentric dwarves, elves, and mages handing out quests and populating its drama. The Kaedweni troops, by contrast, are a bunch of bores and boors. "Oi Witchorr, ye git any poughin' in afore the big battle? Gonna cut me some elf ears tomorrow I reckon..." It all wore thin for me very quickly.

I'd seen enough: I hit the eject button, rewinding all the way to when you choose your allegiance between Roche and Iorveth. Though I'd seen it all before, Vergen is probably the highlight of the game for me – it's got the most of that Witcher colour that I find otherwise absent from *Assassins of Kings*. Sorry Roche, but I guess I'll just see you in the next game. Besides, this is my one chance to hang out with Iorveth – my revolutionary fellow traveller was MIA in 2015.

This doesn't matter

No matter what you do and who you run with in *The Witcher 2*, the board's set pretty much the same way come *The Witcher 3: Wild Hunt*. While trawling for character guides and the like for

this playthrough, I discovered a heartbreaking little forum post outlining an 'optimal' world state to enter *The Witcher 3* with – what fate should you ordain for Vergen, Henselt, the Termerian royal bastards, or the conclave? What will leave the North with the strongest chance against Nilfgaard?

It doesn't matter at all really. I saved Vergen, released Saskia,

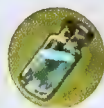
HAPPY HOUR

My preferred Witcher brews



ROOK

Safe, reliable, boring. Rook provides a flat damage bonus with no downsides. Really I'm just interested in its name: this potion doesn't show up in the other games, and I always associated it with chess before finding out it's actually a species of bird.



GADWALL

Another eye-catching name, this one referencing a species of "dabbling" duck. Gadwall cranks down your damage output in favour of tuning up your hit points and health regen. Fairly useful in a game where everything kills you in three hits.



THUNDERBOLT

Glass cannon mode, DPS time. Thunderbolt halves your max hp and regen but ratchets up the damage you deal. With feats that reduce the negative effects of potions, it synergizes with Gadwall to boost you across the board. Shame potions are such a pain to use.

and got that punk Stennis absolutely ganked by a peasant mob, but all this capital-c Choice and Consequence barely registers even a passing mention in *Wild Hunt*. I don't even resent *The Witcher 3* for it – with the third game, CDPR cut the gordian knot, said, "I ain't reading all that," and was stronger for it.

I lay the blame at the *Witcher 2*'s feet for cooking up a headache-inducing spaghetti tangle of bastards, territorial claims, allegiances and betrayals.

The Witcher 2's dozens of end states and moral choices just feel flaccid and pointless compared to the sweep of the whole series – who cares if Flotsam is Temerian or Kaedweni if neither of those countries even exist come *The Witcher 3*? Why on earth would I prioritise founding the Conclave in Loc Muinne if the Witch Hunters always start their persecutions in *The Witcher 3* anyway?

Wild Hunt does track your most important choice in *The Witcher 2* at least: You can keep that goofy little tattoo Geralt gets in a Hangover-inspired sidequest in act 1.



The King of Kaedwen is a jerk, a loser, and you should probably kill him.

Needless complexity without depth

My other big experiment, an alchemy-focused build, was a similar bust. Potions are on an unforgiving timer that does not pause for cutscenes, and Geralt has to pop a squat and load between two menus to even drink them, let alone brew a batch up. At its best, alchemy is one of the series' best flourishes. Potion imbibing contributes to this sense of Geralt's profession: he isn't a fighter, mage, or thief, he's a witcher, and has to fight accordingly.

Even with a mod to boost potion durations, I was feeling the squeeze. My breaking point came with the prolonged ghost battlefield sequence at the end of act 2. Your prepped potions immediately get cancelled, and you have to play as these sluggish wraith soldiers who can't pull off Geralt's dodge roll, but do, confoundingly, benefit from his combat skill tree investments like its active counter. I grabbed another mod to respect, and just facerolled the rest of the game.

I was similarly fatigued by the item system here – you're

inundated with a constant stream of cloth bolts, leather scraps and iron nails, but it still always feels like I never have enough materials to quickly and easily craft *The Witcher 2*'s best gear. It's an unwieldy, frustrating system that makes my jaw clench just thinking about it, but downloading another mod to streamline it all underlined how much these layers of vendor trash and crafting screens obfuscate a simple, stultifying system of "numbers go up."

Finding fun

It isn't all bad – this game is still absolutely gorgeous, no two ways about it. Released all the way back in 2010, *The Assassins of Kings* looks like it belongs to the PS4 generation. The real star, by my estimation, is CDPR's modelling work, and even Geralt's garbage tier early game leather jerkins outshine endgame armour sets from other RPGs in design and detail.

I turned on the infamous supersampling setting for laughs – this ambitious form of supersampling effectively renders every frame of gameplay

four times, and back in the day just brutalised my mid-tier Radeon HD 6790. I got a certain catharsis from pushing 80fps with the setting on, but very quickly switched it off to get an even more buttery smooth 140. *The Witcher 2* established CDPR's tech legend: the studio that three years before was making a wonky game for nerds on the *Neverwinter Nights* Aurora engine was now all of a sudden running with the big dogs and producing some of the best visuals in gaming. I will always admire *The Witcher 2*'s ambition, from its visual advances to its mutually exclusive second acts.

I appreciate *The Witcher 2* as an evolutionary step in a series I love, and I'll never turn down more Geralt, but I'm finally at peace with being a *Witcher 2* hater. After beating it two and a half times over 13 years, I'm comfortable rating it pretty low, a merely OK RPG in between two favourites. I'm really glad to finally play *The Witcher 3* with that tattoo though – I crack a little smile whenever I notice that strange little topless lady on Geralt's neck. ■





RETRO

The impact of The 7th Guest

When Trilobyte launched the interactive movie horror adventure *The 7th Guest* 30 years ago, it had a major impact not just on PC gaming but PC hardware, too. David Crookes solves the puzzle of its success.

By the early 1990s, gamers had become used to swapping floppy disks. Not just in the sense that they were passing them to their friends in the school playground or in offices up and down the land: we're talking about the umpteen disks that were often needed for people to play the increasingly complex titles that were being released.

"Looking back, it was pretty crazy," said videogame developer Graeme Devine, who began his career in 1982 porting *Pole Position* for Atari, aged just 16. "We all seemed very willing to slot 20 floppy disks into our computers to install and play a game, although I'd got really good at compressing PC titles so that they'd fit onto fewer disks. More disks meant increased costs, after all."

Although this skill ensured

Devine had plenty of work – "you could rewrite the BIOS really easily and fool it into thinking a floppy disk was twice as big as it actually was" – it nevertheless added to development time and still led to the need for multiple disks. Yet the games industry, despite having long made use of cartridges, appeared happy to persevere with floppies and, in doing so, wasn't seeing the potential of another rather more shiny medium.

Meteoric rise

It was the early 1990s and Devine's career had continued to soar. He'd created *Metropolis* in 1987 (a game he's currently in the midst of remaking) as well as *Turbo Champions* and *Spot*, among a clutch of other games for a host of 8-bit and 16-bit computers.

He'd also moved from the UK to

Above: Graeme Devine has had a lifelong love of horror.

the US in 1988 to assist in the opening of a new office for Mastertronic. "The PC was coming into its own after the Commodore 64, Atari ST and Amiga," he told APC. "I was keen to experiment and see what the PC could do for games."

For much of the 1980s and early 1990s, adventure games had reigned supreme on the platform. "Sierra On-Line games were probably the most popular," Devine said. "The developer made *King's Quest*, *Space Quest* and *Police Quest* as well as *Ultima: Escape from Mt. Drash*." But other genres were making an impact, too.

"The *Links* golf games were a big hit and then you had *Doom*, which was only really playable on the PC," Devine added. "No-one other than *Doom*'s creator John Carmack could work out how to do

binary space partitions. The PC was definitely becoming exciting as a gaming platform."

Give us a clue

By this time, there had also been other developments, most notably the release of adventure game *The Manhole* on CD-ROM in 1989 for the Apple Macintosh, as well as the launch of the Philips CD-i in 1990. With hindsight, it would seem obvious that compact discs would replace floppies as the storage of choice for games but, by 1992, this still hadn't happened.

The situation surprised Devine, and he shared his frustration with Rob Landeros, who also worked for Mastertronic (which was, by now, Virgin Mastertronic). The pair struck up a strong friendship and they maintained a keen eye on emerging technologies.

"We were both very bullish about the Philips CD-i," Devine said. "We thought it was going to be huge."

To discover more about Philips' digital optical disc data storage format and the accompanying CD-i players, Devine and Landeros attended a conference in New York. "I don't know how much of this story is true any more because I tell it so many times and I think it's different each time," he laughed, "but we went to the multimedia conference for the launch of the Philips CD-i yet all the titles we saw were dictionaries and encyclopaedias.

"We were sitting there thinking about this huge storage format that would store a bunch of images and yet no-one was talking about the advantages it would have for games. I recall one talk about a patented word search that could scour a dictionary really fast on CD-ROM and thought it was just wrong. They were addressing a temporary, two-year problem and that wasn't, in my mind, what CD-ROM was all about. So Rob and I came up with a plan."

Give us a Clue

For a good while, the pair had been pushing Virgin Mastertronic to allow them to remake *Cluedo* (or *Clue*, as it's known Stateside). "Mastertronic

owned Melbourne House, which had the rights to *Clue*, and we both liked board games and thought we could do a better version than what had been made before.

"At the time, the *Twin Peaks* television show was airing and we absolutely loved it. Our initial pitch was, you know, *Clue* but like *Twin Peaks* and that would have been great, looking back on it. But Rob loved playing *The Fool's Errand* and it took us in a slightly different direction." *The Fool's Errand*, released in 1987 for the Mac, combined visual, brain-twisting puzzles with storytelling, and it quickly became a cult classic.

"Our game evolved into a story about a haunted house that was full of puzzles to solve," Devine said. "We originally called it *Guest* and went to the co-founder of Virgin Mastertronic, Martin Alper, to get the go-ahead,

but we had to promise that we'd make a floppy disk version because he said there was no way the publisher would make money on a CD-ROM version."

Even so, Alper wanted to see the game on CD-ROM. He'd looked at the proposals for the game, saw the potential and understood how CD-ROM would be beneficial. But if the pair wanted to go ahead and create it, there was a catch: Devine and Landeros would need to leave Virgin Mastertronic and do it under their own steam as an independent developer.

According to Alper, office politics and the need to create a new division within the company



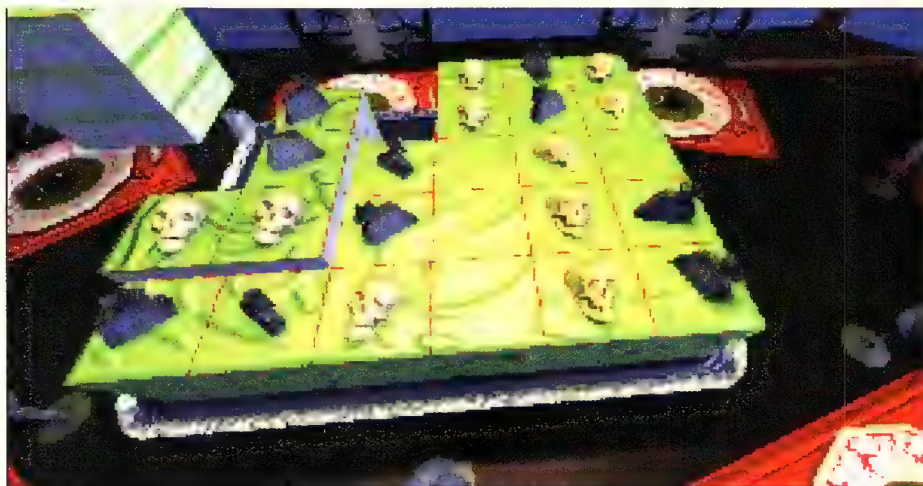
would make in-house development difficult. But he told the keen developers that the company would publish the game. It led to the creation of Trilobyte and a game that would have a huge impact not just on PC games, but on PC hardware as well.

A shiny start

"We had watched *The Shining* over and over and over," said Devine, of the 1980 psychological horror starring Jack Nicholson that went on to inspire their game – the newly named *The 7th Guest*. "When *The Shining* finished, we started watching it again. In fact, we watched that movie so many times that it couldn't fail to influence us – we had it on laser disc and wore it out."

Gradually, a story emerged based around a haunted house that also had elements of *Scooby-Doo* – a cartoon that Devine continues to love even today. The

In this puzzle, all six guests need to be given an equal slice of cake.





pair drafted in horror writer Matthew J Costello to write the script, and they decided to make full use of the CD-ROM's capacity by opting for live action, with real actors alongside pre-rendered 3D graphics.

"It was actually easy to do but that's only because of Debra Ritz Mason, who played Martine Burden," Devine said. "We had a two-day film shoot above a comic bookstore in Medford, Oregon, and, because Debra owned the Rogue River Motion Picture Company she was able to organise the whole thing."

"She was the perfect actress and she got all the costumes, all the

directors. All we did was show up with our Super VHS camera and a blue screen I'd bought from the hardware store Lowe's and say, do it all on this stage. Debra was, like, okay and got on with it. It's a terrible shame she passed away in 2006."

"We had to promise we'd make a floppy disk version because there was no way the publisher would make money on a CD-ROM version"

What emerged was a spooky tale in which gamers moved through a deserted mansion from a first-person perspective, solving puzzles while encountering

various characters. As they did so, they would learn more about one evening in 1935 when a drifter called Henry Stauff had killed a woman then gone on to create toys, which after being sold to

Graeme Devine battling zombies with his daughter. They're not trying very hard though, and deserve to have their brains devoured.

The 7th Guest starred a host of real-life actors, all with their own personalities.

local children, caused them to die of a mysterious illness.

With six guests invited by Stauff to spend the night at the mansion, the idea was to open up more and more areas until the identity of a seventh guest was uncovered. It was creepy and disturbing, leaving players on edge. "There are points where I look back and I'm like, 'wow, that's pretty horrific'," Devine said. "It's not as Scooby-Doo as I fondly remember!"

Even so, it was a masterpiece – especially when you factor in when it was made, though Devine sees it more modestly. "We somehow blundered our way through, capturing everything on Super VHS and, at times, it was like scaling a cliff without knowing the pickaxe. It was an adventure in itself and there was no internet or BBS that we were on. There was no communication with anyone."

It led to some flaws that, nevertheless, have become part and parcel of the game's experience. "All the ghosts have a haze around them, but that's because we couldn't get the blue screen out completely," Devine added. "They're all more translucent than we intended them to be because the Super VHS was so jagged, we had to bring it down to 15 frames a second to get rid of the interlace. Although we didn't even know what interlace was!"

Making a splash

In order to get paid, the Trilobyte team needed to meet certain milestones along the way. Eventually, they were able to show something of note and so they headed to Las Vegas where they knew Virgin Mastertronic and Alper were displaying the publisher's latest games at the Consumer Electronics Show.

"We needed to get our milestone money because we were poor," Devine explained. "We were basically eating ramen noodles to make the game and it certainly wasn't being done on a high budget. When we arrived in Vegas, I showed Martin what we'd done in a private meeting room and he was blown away. He's like, 'we've got to put this on to the floor', and we were like, 'but it's not ready for the floor'. He did it anyway."

It didn't take long to make an impact. "The booth became packed and crowded just to look at this one game – our game," Devine continued. "Then Roberta Williams from Sierra On-Line came along and we got Game of the Show. I think that really opened Martin's eyes





and, from that point on, we got more attention from Virgin. We could also go and get a larger hard drive!

"I remember on the flight home with our milestone approved and the cheque coming that Rob and I were worried. Now we'd actually have to finish this thing. I think I had a pit in my stomach."

But they needn't have worried. The team did indeed finish the game, and it ended up being released in April 1993. It began to attract attention from other videogame developers, too. "I think Westwood Studios, which made *Command & Conquer*, came up and they were interested in how we compressed things," said Devine. "I spoke to John Carmack about frame control and how we controlled CD-ROMs for audio - *Quake* uses the same music player from *The 7th Guest* because I gave him the source code for it."

Myst effect

Yet there was one game that Devine didn't know about: *Myst*. Produced by brothers Rand and Robyn Miller, it also ended up being released in 1993 and it also made use of CD-ROM tech. "The first time I saw *Myst* was in Costco and, on the very front of the box, it said, 'leapfrogs Trilobyte's *The 7th Guest*' and I thought, 'what the f***?' but I bought it and it was cool. Later, I read an interview with Robin Miller and they were asked if their game would be better than *The 7th Guest* and he said, 'seventh what?' We both made our games independently of each other."

Even so, the accumulative effect was

Above: The cans have to be rearranged to form a sentence.

Right: A lengthy intro set the scene for *The 7th Guest* and the spooky goings on in the mansion.



huge. "*Myst* had an impact on the Mac market and we had an impact on the PC market," Devine said. Indeed, two million copies of *The 7th Guest* were sold, and it is said to have been the catalyst for CD-ROM sales, too. "I think our game was the thing that got a lot of CD-ROM drives into computers, you know, although we didn't get any royalties from that."

"Then some months later, *Myst* also came out on PC as well and it was like proof - validation; a case of look, I bought this CD-ROM drive for *The 7th Guest* and now there's this second great game, *Myst*. I'm more than happy to have both games lumped together. That's kind of an honour."

It wasn't all entirely positive,

however. While the reviews were strong, the press jumped on the adult nature of *The 7th Guest*, which was released at a time when the industry was still in the early days of discussing age ratings. "I think Congress was beginning to look at the games industry and say, regulate yourself or we will regulate for you," Devine said. "But a rating on the box is only as good as the retailer that sells it, too."

Still, he's more than happy at the legacy of the game 30 years on. "People come up to me today and say they were terrified when they watched their parents play *The 7th Guest*," Devine said. "And I'm like, cool. It's one of those games that people have a shared experience with."

"*The 7th Guest* also influenced other games such as *Silent Hill* and a bunch of FMV titles, I guess, and I find it hard to imagine what my life would have been like without it - it changed and defined me." It also saved a heap of floppy disks from being made. "Yeah," Devine laughed. "We saved a whole bunch of trash from 21 extra disks of games. It certainly left an imprint." ■

The idea for putting a game on CD-ROM came after Devine and Landeros saw the Philips CD-i.





NOTHING FOREVER AI-GENERATED SEINFELD TEMPORARILY CANCELLED

GPT-generated TV show pulled for transphobic stand-up.

A novel cartoon rip-off of *Seinfeld* called *Nothing Forever*, which was being randomly generated in real-time by a GPT-3 AI and aired directly to Twitch, managed to attract tens of thousands of concurrent viewers in under a week, when it launched at the start of February. The unusual combination of poorly timed laugh tracks and absurdly bad dialogue was often strange and nonsensical, but could occasionally align to create laughably ridiculous scenarios and dialogue. While *Nothing Forever* was intended to run uninterrupted well into the future, Twitch imposed a 14 day ban on the channel for breaching its Community Guidelines or Terms of Service following a bit by generated-Jerry-Seinfeld-character Larry Feinberg on transgender and liberal people.

what new discoveries from the James Webb Space Telescope can tell us about...
 You'll never see the three most discoveries made by the James Webb Space Telescope (JWST).
 In 2023, the JWST spotted a number of galaxies nicknamed "green peas." They were given this name because they are small, round, and green. The peas.
 The telescopes captured images of galaxies that are over 13 billion years old. This means that the light from these galaxies has been traveling for over 13 billion years to reach us.
 JWST took the very first pictures of a planet outside of our own solar system. These distant worlds are called "exoplanets." The "peas" from inside.
 These discoveries are such a thrill to us, and we're excited to share them with you.

GOOGLE'S AI CHATBOT IS REALLY BARD

Alphabet stock price slid by 9 percent after ChatGPT-competitor mistake.

Whether it's the ability to provide answers to complicated coding queries, or its skills in recommending books to read about historical figures, ChatGPT is showing the world how capable it is of answering en-par with, or even surpassing, Google's web search results for many types of queries. And while Microsoft may have fumbled its way into a competitive position here by being a major donor in OpenAI, its decision to integrate a version of GPT-3 in its Bing search engine could be enough to take the reins from search incumbent Google. This is at least part of why Google rushed to launch its own Bard chatbot publishing a factual error it made about the James Webb telescope in a Tweet in February.

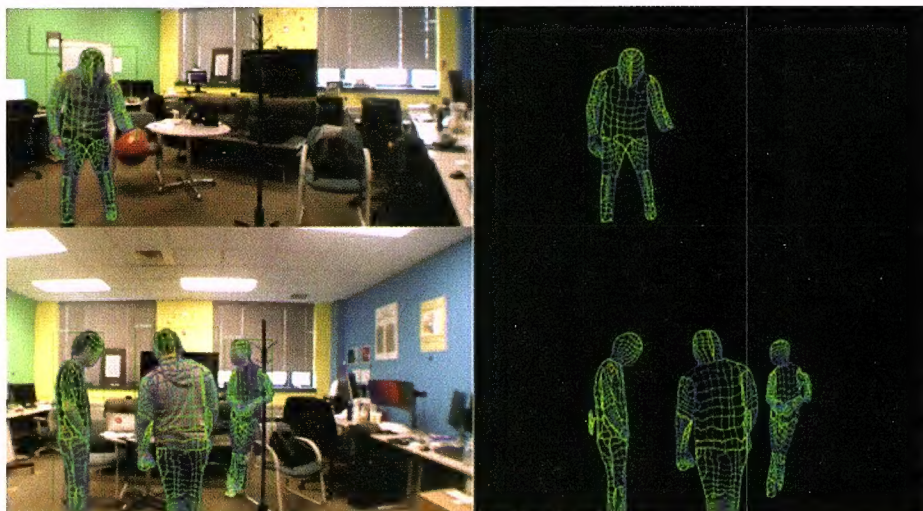


CHIP CHAT

Lol Verifier

No one cares if you laughed on the inside.

Sometimes when we write 'lol' we have not actually lolled, which can be a problem for some. Maybe you want to catch your employees' attempts to be polite when you rip a good thigh slapper and they don't appreciate it enough, or you need proof that your dad is just pretending to laugh at mum's jokes - whatever your particular predicament there's finally a tool that will distinguish between the dishonest lols and the IRL ones. According to a Tweet by its creator @lanewinfield the Lol Verifier device sits in between your keyboard and PC and will only allow you to type 'lol' if its inbuilt AI microphone detects a real laugh.



DENSEPOSE WI-FI CAMERA

Routers can now watch you like a camera that you can't tape over.

When it comes to Wi-Fi routers, humans are basically giant meat shields that reduce the device's ability to deliver a stable network. But it seems one router's meat shield is another's chance to see and interact with the world around it. Researchers at Carnegie Mellon University have developed a Wi-Fi signal detection software that allows networked routers to triangulate coordinates and even map the physical outlines of any human-shaped signal roadblock in a room. The researchers propose that it can turn basically any router into a Neo-like data camera that keeps track of where us meat sacks are... a neat bit of tech that will help ChatGPT to shoot us through walls once it achieves full sentience. ■



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* Source: 2003-2021 OMDIA data
NAND suppliers' revenue market share